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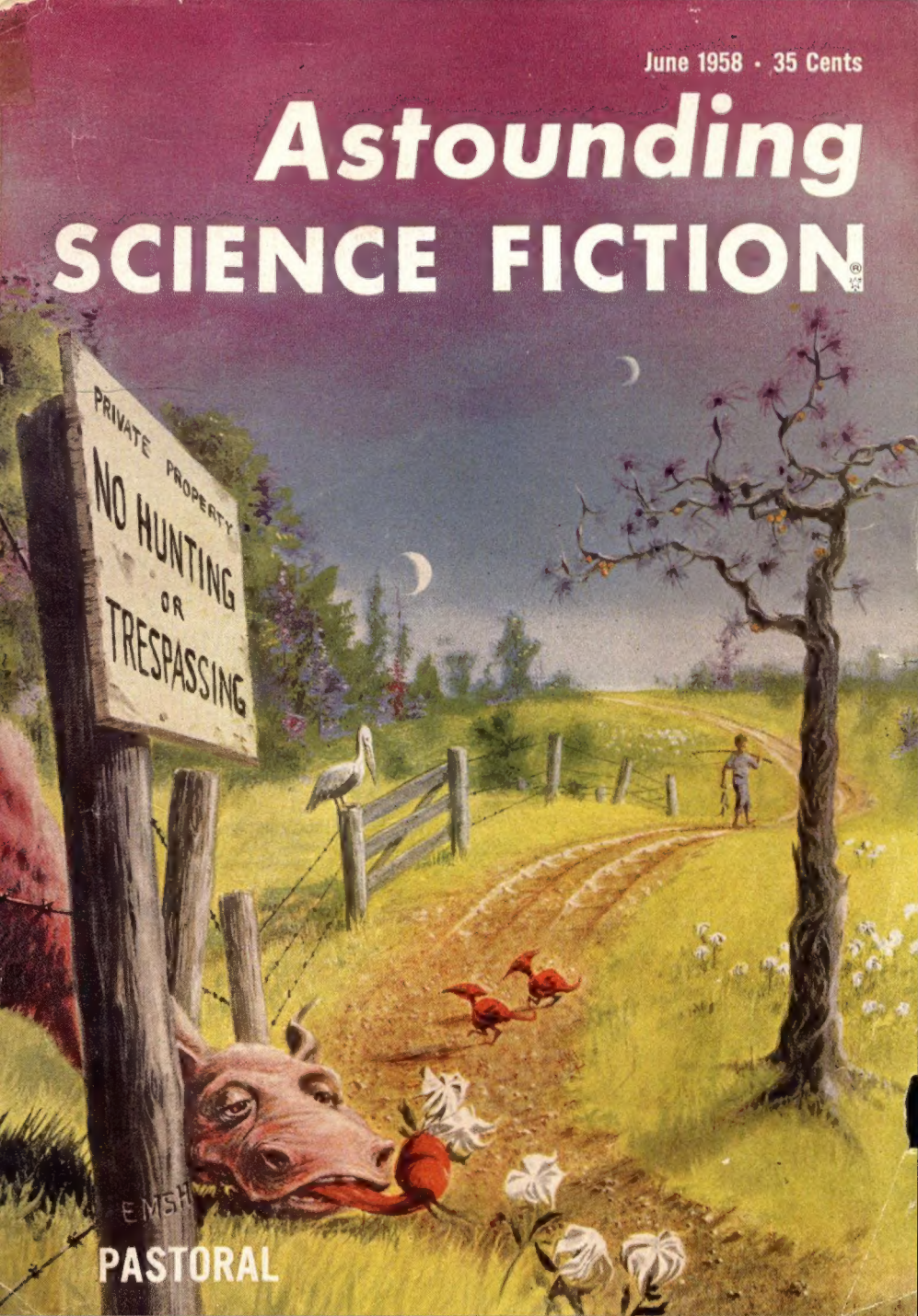

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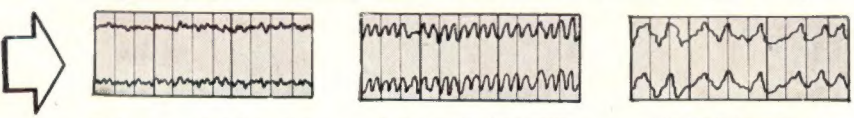

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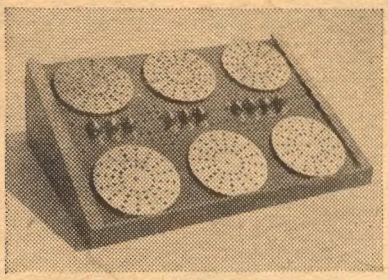

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VOL. LXI • NO. 4

Astounding SCIENCE FICTION

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H. A. Staab, *Art Director*

COVER BY EMSH
Illustrations by Freas, Schoenherr and van Dongen

JUNE 1958

Astounding SCIENCE FICTION published monthly by Street & Smith Publications, Incorporated, at 575 Madison Avenue, New York 22, N. Y. Arthur Z. Gray, President; Ralph R. Whittaker, Jr., Executive Vice-President; Arthur P. Lawler, Vice-President and Secretary; Robert E. Park, Vice-President and Advertising Director; Thomas H. Kaiser, Treasurer.

Entered as second-class matter at the Post Office, New York, N. Y. Subscription $3.50 for one year and $6.00 for two years in the United States, Possessions and Canada; $4.75 for one year and $8.00 for two years in Pan American Union, Philippine Islands and Spain. Elsewhere $5.00 for one year and $8.50 for two years. When possible allow four weeks for change of address. Give old address and new address when notifying us. We cannot accept responsibility for unsolicited manuscripts or art work. Any material submitted must include return postage. All subscriptions should be addressed to Subscription Department, Street & Smith Publications, Incorporated, 304 East 45th Street, New York 17, N. Y.

Printed in 173 *the U. S. A.*

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CONCERNING...

DR. EDWARD TELLER has stated his belief that Science needs a strong, active body of science "fans" to support it in this country. Dr. Teller made the statement in *Time* magazine, and before the Senate Investigating Committee.

I am in fullest agreement with Dr. Teller's statement . . . but I evidently have a different interpretation of what the term "science fans" means. From what I can make out, Dr. Teller, like many other professional scientists, wants a strong, active body of science *rooters*—loyal followers—partisan backers. A fan is something quite different. And fans, not loyal followers, acolytes, worshipers at the altar of Science, is what Science does indeed *need* . . . but what Science doesn't particularly *want*.

The uncomfortable thing about true fans—may I speak from personal experience?—is that they're just as apt to yell loudly and determinedly "Throw that bum outta the park!" as to root for the player.

The true fan is loyal to the *game*, and *not* to either player or team. Baseball, the Great American Game, is a fine example of the tendency of true fans; fans will buy a Babe Ruth a new ball park . . . and they'll also throw even the beloved Babe outta the park when he can no longer maintain the peak pace the Game demands. It's doubtful that The Babe felt he was no longer as good as the best—but the fans are quite hardboiled about such things.

Also, the fans force changes in the rules of the game, that will make the game a better Game. Sure, it's always the professionals that *make* the changes . . . but it's the pressure of the fans that force them to make them.

A strong, active group of science fans would be most irritating and annoying to the professional scientist. For one thing, the fans would be laymen, with no real training in Science. But Science would have to listen to them, pay heed to their remarks, and change the rules of the Game at the behest of these inexperienced and unqualified laymen.

Because if the players pay no attention to the fans, the fans get bored, and go somewhere else.

Only acolytes, worshipers, the

. . . "SCIENCE FANS"

loyal faithful followers, sycophants, and the like hang around where they are not respected and their thoughts and desires given no weight. Fans are Participating Junior Members; drop out the participation . . . and there are no fans.

Dr. Teller has not recognized this adequately; professional Science has not recognized it. Consequence: Science has darned few fans. The interesting fact is that science-fictioneers constitute the largest actual science-fan group in the country—and professional Science (unlike many individual professional *scientists*) sniffs an uplifted nose at science fiction.

Indication: when the Army, back in 1947, wanted to discourage, to demean, the very idea of an Earth Satellite, they said that it was "for science-fiction writers."

You know, they were perfectly correct. It was. It was for the science fans. The science fans wanted to "change the rules of the Game"—the rule that said Earth Satellites were nonsense.

Professional science continues to ignore science fiction; Dr. Teller certainly made no mention of the two hundred thousand or so actively participating science fans that science fiction represents.

The present situation is that most science fans are either professional scientists in a different field—a chemist is a physics fan—a science student who hasn't yet specialized, or a science-fictioneer . . . and usually is a member of two of those classes.

It's widely recognized that no individual can trust the validity of his own thinking, without cross-checking with another individual. Our own pet beliefs and prejudices blind us to errors in our own thinking.

Is this any less true for a group? Can Scientists trust their own group-thinking any more than an individual scientist can trust his individual thinking?

The freely communicating world of science has been an ideal; it is something scientists strive for, and something which, right now, they worry about because of security barriers impeding the free flow of international scientific information.

Funny thing . . . Science has a tendency to leap forward when security barriers start strengthening!

(*Continued on page* 158)

Some are born great, some achieve greatness—and some, it seems, have to have greatness shoved down their throats with a force pump!

HEIR RELUCTANT

BY

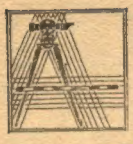
ROBERT SILVERBERG

I

". . . Perhaps the knottiest problem that confronts one whose task it is to provide for the development of a young and newly-independent world is the question of transfer of power. The stresses of a planet's initial colonial years give way to the very different stresses of early self-government, and the man who leads the government in its first stages must be an extraordinary one. Paradoxically, however, the potential leader is not always anxious to assume the burden of rule, and frequently may be obstinately reluctant to do so . . ."

Dynamics of the Colonial Process
Dawson

Illustrated by Freas



DRY, dusty wind was blowing across Dannon City from the east, kicking up fallen leaves in the broad plaza before the imposing dwelling of the Terran Resident Protector on Dannon's World. It was a storm-carrying wind, David Kilross thought, looking out into the plaza.

Well, he expected a storm. He had been Resident Protector here long enough to know when a storm was on its way.

He turned away from the window, conscious of the slightly-higher-than-Earthnorm pull of gravity. The dark gray-purple clouds scudding overhead had put him into a somber mood. He clenched and unclenched his fists. He wanted to talk to somebody; anybody, it seemed, as long as he could communicate some of the thoughts and plans that spun in his head.

Kilross walked to his desk, opened a communicator channel, and spoke quickly and crisply. A few moments went by; then the area on the far wall where the solido-projector was glowed a soft yellow, deepening to green as the figure of a man appeared.

The image facing Kilross was that of an Earthman, short and thickset like himself. He was Merrill Stoneham, Protector of Lannimar, fourteen light-years away. Stoneham and Kilross had entered Colonial Service together, a decade earlier. They were old friends.

Without preamble Stoneham said, "Dave, I read your report in *Extracts*. I was going to call you about it. You're taking a big chance, you know."

Quietly Kilross said, "I know. I was always a pretty fair gambler."

"But you're gambling with a *world*, now! Are you sure you're right?"

An enigmatic expression entered Kilross' eyes as he said, "Can we ever be sure? We manipulate gigantic forces, Merrill. How do we know we won't crush ourselves?" He knotted his hands together. Behind him, he heard the first downward lashing sweep of the storm, the heavy thudding of the rain against the dry streets of Dannon City. Kilross said, "This planet is right on the edge of independence. I'm going to give it to them."

Stoneham shrugged. "I suppose you know what you're doing. *My* planet's at least a century in the future, so far as the question of independence goes. But I won't question your statement. Except that your *Extracts* article said that Dannon's World faces a possible dictatorship if Earth grants independence now. And yet, in the teeth of that statement, you go right ahead. How come?"

"I've got an ace in the hole," Kilross said. "A natural leader, the sort of man you don't come across often. His name's White. Austin White."

Frowning, the solido-projection of Stoneham said, "If he's so good, why isn't he ruling now? Your arti-

cle said a man named Henderson was the local top man."

Kilross leaned forward avidly. "Don't worry about White. He's busy now, with other things. But he'll take over, when he's needed. I'll bet five years of my pension on it."

Stoneham stared levelly at his fellow administrator for a long moment, smiling in a sort of grudging admiration. After a while he reached beyond the solido field with his left hand, and drew a half-full glass toward him. He waited while Kilross could pour a drink of his own.

Stoneham raised his glass. "Here's to you," he said.

Fourteen light-years away, on Dannon's World, Resident Protector David Kilross shook his head and grinned. "Here's to Austin White," he responded. "The future premier of Dannon's World. Only he doesn't know it yet."

At the moment the two Terrans drained their glasses, the object of their discussion was entertaining a member of the local planetary government in his downtown flat.

Austin White's apartment in the heart of Dannon City had the sterile, barren appearance one would expect of the home of a bachelor with a predilection toward tidiness. Above everything else, White was tidy—whether in laboring over the mathematics that was his chief pleasure in life, or in keeping his few personal possessions in their proper places.

A few pieces of golden-hued driftwood were the only ornaments in his flat. He did not believe in cluttering up his home with bric-a-brac, any more than he believed in cluttering up his mind. He was a tall man, not yet forty, with dark close-cropped hair and a lean muscular frame. His face was particularly striking: thin fleshless lips, a triangular wedge of a nose, eyes that never seemed to be looking *at*, but always *past* and *through*. He was a fifth-generation settler on Dannon's World.

His guest was Bernhard Klein, a third-generation man of Swiss-Terran extraction. Klein was Minister of the Arts in the cabinet of Premier Henderson. And for the past two months, Klein had had much the same thing to say to White each time he visited him.

"Dammit, Austin, if there's a revolution on this planet next month it'll be your fault!"

White frowned, sighed, stubbed out his cigarette. The rain was a tumultuous drumbeat outside, battering the windows and the rooftops of the city and washing the soil from the gaunt purple hills that ringed it in.

"You always lay the blame so directly at my door," White said. "As if I could have altered the situation by sacrificing my private life to oppose Henderson—"

"Your father and your grandfather before him had no objections to sacrificing their private lives," Klein reminded him a little icily. Klein was a small man, soft-spoken, with a de-

termined glitter in his pale green eyes. "*They* were willing to run. They served Dannon's World thirty-five years between them, as Premier."

"Be reasonable, Bernhard." People would never understand. "They wanted public life, and they got what they wanted. I want something else."

And, he added silently, *I watched them waste their lives in a futile attempt at governing. You can't govern unless you can teach the people to rule themselves. Dad and Granddad knew what needed to be done. They just didn't know how to go about doing it.*

That was what White was trying to find out. He was searching for an equation, a mathematical formulation for human communication. For a decade, he had known that the end of his goal was in sight. Another five years, perhaps, another ten, another fifteen—

He worked at it, with single-minded intensity that made some people think he was strange. He didn't care. In his eyes, his work came first, before all else. Before family, before friends, even before his planet. He had suffered for that, but he stuck to his purposes. There was time to explain later, after he had succeeded.

Coolly White lit another cigarette and dialed a drink. He leaned forward and snapped a musicdisk into the socket. It was Bach's Third Brandenburg Concerto; it relaxed the somewhat overtense atmosphere of the room.

Klein drummed for a moment on the edge of his chair. He seemed to be weighing his words, measuring them for their maximal persuasive effect. At length he said, "I came here for a specific reason tonight, Austin. I came to ask a favor."

"Ask it, then."

"No. Not yet. First let me say this: I want you to hear me out, and not answer me until I'm finished. And I want a simple answer, yes or no, you understand? Also I want it clear that I'm asking it in my official capacity as part of Premier Henderson's cabinet, not simply as a friend of yours. I hope it won't have any future effect on the relationship we—"

The lengthy prelude annoyed White. He smiled suddenly and said, "All right. What is it you want, Bernhard?"

"Simply this. Premier Henderson has drafted a fourth Home Rule petition. He requests Resident Protector Kilross to forward the petition to the Colonial Council on Earth for immediate consideration."

"Henderson's going to get the same reaction he did the last three times. Kilross will make polite noises and toss the petition in the disposal the minute Henderson turns his back. I don't see—"

"I haven't told you yet," Klein said sharply. "Henderson feels that perhaps the wrong approach has been taken in petitioning Kilross, up to now. He thinks perhaps if some well-known citizen served the petition, somebody respected by all but

not an actual member of the government, Kilross might take the petition more seriously."

"No," White said immediately. A stiff week of important calculations awaited him. "I'm not interested in taking a job as a process server, if that's what you're driving at."

Klein shrugged. "I guess I should have expected it. Very well. But consider this—and what I say is strictly *entre nous.* Henderson anticipates a fourth rejection of the petition. He expects it. And he says that if Kilross turns it down again, he's going to declare Dannon's World independent of Earth anyway, and expel the Terran Resident Protector."

"That's revolution. The cabinet and the Assembly won't let him do any such thing."

"We can't stop him," Klein said. "Henderson happens to have full executive control over the military. He can touch off a one-man revolution if he feels like it. And I *know* he feels like it. Henderson's utterly ruthless. Do you know him?"

"I met him once. I didn't care to meet him a second time."

"O.K.," Klein said. "You saw who he is and what he's like. Now, if you refuse to go to Kilross and give him the petition—dammit, Austin, you'll be touching off that revolution as sure as if you fired the first shot!"

White was silent for a long time, scowling. Why did they never let him concentrate on his work? Why were they always claiming portions of his time? He had watched two earlier generations of Whites fritter away their lives in futile attempts to preserve the bonds of civilization, when they could have been working on—

He stared at his thick strong hands and wished Klein had never come this evening. He did not look up.

Klein said quietly, "If you had wanted the premiership seven years ago it would have been yours on a platter, and you know it, Austin. But you decided not to take it. You said your family had bossed Dannon's World for two generations, and that was long enough. So you turned the job down and eventually Mark Henderson grabbed it. O.K. You have your own life to lead. But I'm asking you to grant half a day of your precious time to your planet and go to see Kilross. How about it?"

Without answering, White rose and walked to the window. It had stopped raining, and the streets were darkly wet. Neat, symmetrical streets; the founding fathers had planned well. A rainbow arched splendidly across the sky, dropping sharply behind the steely rim of the mountain wall. Golden shafts of sunlight broke against the pavement.

White turned and his eyes met Klein's. The small man had been damnably persuasive. And he had no choice but to accept, anyway.

In a tired voice he said, "You win, Bernhard. I'll go to Kilross if you think it'll help."

II

". . . In choosing a native-born leader for a newly-independent colony world, the Terran Resident Protector must seek a man with the qualities of sound leadership. That is to say, the man of his choice must have deep-rooted inner ethics, toughness of mind and of purpose, and a certain ruthlessness, a willingness to undertake difficult tasks without reference to self or to public clamor, if he sees the overall result as beneficial. In short, the Resident Protector must seek a man who has essentially the same characteristics as himself, though these traits may manifest themselves in subtle and sometimes awkward manners . . ."

Dynamics of the Colonial Process
Dawson

In the immediate pre-independence years of a colony world, the Terran Resident Protector is normally the most important single individual on the planet. He is chosen on Earth, by the Colonial Council, and his appointment is for life. It is his task to review any decisions of the local colonial government, give advice when necessary, intervene openly when affairs called for intervention.

David Kilross, Resident Protector of Dannon's World, had held his post seven years. He had been appointed on the death of his predecessor in 3107, and had arrived to find himself Protector of a thriving, fully-industrialized Earth-type world well on its way to winning the coveted Home Rule status that amounted to absolute independence within the loose framework of the Terran Commonwealth.

He had finished his solidophone conversation with Stoneham on a hopeful note; Stoneham had his hands full on Lannimar, peopled by brawling miners and smelters, and Kilross had offered him some advice. Then, breaking the contact, he returned to the job of drafting his monthly report to Earth. The communicator panel on his desk lit up suddenly. He nudged the acknowledger and said, "What is it, Cronin?"

His attaché for local affairs said, "Sir, there's been a call for you from an Austin White. He wants an appointment with you for this afternoon. I told him you were writing your report, but he insists it's important."

Kilross' eyes narrowed briefly. "Tell him I'll see him," the Protector said. "The report can wait."

Cronin protested, "The report, sir! The Council always screams if it's the least bit late, and—"

The attaché was earnest, Kilross thought wearily, but a little dull. "The Council can learn to have patience, Cronin," he said sharply. "Tell White I'll see him today."

"Very well, sir."

The panel went dead.

He's coming! Kilross thought exultantly. The complex plan was beginning to unfold.

Kilross had met White only once before—seven years ago, when he had arrived on Dannon's World to take over for dead Jackson. The head of the local government then had been the vigorous, popular Richardson White. But White had died sud-

denly of pneumonia only six weeks after Kilross' arrival; and the Premier's son, Austin White, had emphatically turned down all bids to succeed his father.

After Richardson White had come a series of short-term Premiers, their names already half-forgotten: Marrick, eight months; Duval, seven months; Keswick, fifteen weeks. And then, two years ago in 3112, Mark Henderson.

A brisk, efficient man, Henderson began his career as a local selectman in a southern city, and rapidly had swept his way northward to the capital and the premiership. Running unopposed on a platform of reconstruction, Henderson easily won the approval of the people. He announced he would undo the damage caused by his weak-willed predecessors. He called for speedy expansion of industry, increase in the export balance, and prompt colonization of the uninhabited continent to the east.

Within a few months he had restored the Dannon economy to the healthy position it had enjoyed before the death of Premier White. Within his first year in office, a city was rising on the western shore of the far continent. Superficially, he had done a good job.

But, Kilross thought, *Henderson was a fool. A dangerous fool at that, brutal, ruthless, self-willed.* Kilross had allowed him to attain the premiership only because he intended to use Henderson as a lever in a greater plan.

The communicator glowed again. "What is it, Cronin?" Kilross asked.

"I called White and told him what you said. He'll be here in an hour."

"Good."

"Do you want me to bring you the dossier on White, sir?"

"It won't be necessary." Kilross chuckled. "I know all I need to know about Austin White, Cronin."

"It wouldn't be any trouble for me to bring it in—"

"Not necessary," Kilross snapped. "I'm briefed on White already. I offered him the premiership back in 3107. That was before you came here, I think. He turned it down."

"Turned it down, sir?"

"That's right." Kilross smiled at the memory. "Said he was too busy on a project of his—deriving a set of mathematical parameters of human communication, I think. So I gave the job to Leon Marrick. But White's going to be in office soon. He's going to succeed Henderson."

"What's that, sir?" came the startled voice of the young attaché.

"I said he's going to succeed Henderson. He doesn't know about it, yet, and if you told him he'd say you were crazy. But I know my man, Cronin. I've watched him for seven years." Kilross laughed. "Get a good look at him when he shows up, Cronin. It's instructive to see him. He's tough. One of the most solid human beings I've ever seen."

"I'll look at him, sir."

Still chuckling, Kilross broke contact and turned back to his work.

White's tough, all right. And capable. But it's a lucky thing for Dannon's World and for him that I'm a little bit tougher.

Austin White was thinking about Resident Protector Kilross as he rode crosstown that afternoon. He disliked the man. More on impulse than on actual knowledge, for he had had very little contact with Kilross. But he blamed the man for the slow, steady onset of decline in Dannon's World's affairs. Kilross had let the planet drift.

And after Henderson had appeared to set right some of the haze of confusion five years of incompetent government had caused, White thought, Kilross had behaved increasingly negatively. Eleven months after his election, Henderson had fulfilled his final campaign promise by presenting to Protector Kilross a petition for Home Rule status for Dannon's World.

Kilross ignored it.

A month after the petition had been presented, Henderson inquired when Earth planned to act on it.

"The petition was never forwarded to Earth," Protector Kilross coolly informed the people of Dannon's World. "The time has not yet come for Home Rule here."

The announcement caused much bitter comment. And, six months later, Henderson presented a second petition. It met with the same fate as had the first.

And so did the third.

Now, White thought, the time

had come for a fourth petition—and this was the last one. He carried the document in a leatheroid portfolio dangling from his left hand; he rode across town in the monobus in a mood of chilly resignation, not anxious to take part in any of Henderson's political maneuvers but aware that in good faith he could not have refused Klein's request.

Governing a planet is a hopeless job, he thought. *Dad and Granddad tried it. They failed. They were capable, but shortsighted. They didn't realize that before you can govern properly you need a science of governing. You can't just improvise.*

That was why White had declined public office. He aimed for the higher goal. Let others struggle with routine administrative work; he worked on a more theoretical plane. He understood the futility of governing without a science of communication to guide him. Instead of taking the job everyone wanted him to have, he preferred to explore the essential basic concepts of reaching people. It was a much tougher job.

At the entrance to the Protector's residence he paused and nudged the signal stud. The scanning beams whisked over him quickly and a deep voice said, "You may come in, Mr. White."

The door slid back. A blank-faced servant-robot stood just within. It bowed perfunctorily and said, "Will you come this way, please?"

White followed the servo down well-lit hallways into a narrower corridor. There he was met by a slim young Earther who introduced himself as Cronin, attaché to the Protector, and who stared at him most intensely before leading him inward to the door of a secluded office.

Cronin touched a knuckle to the doorplate; the paneled door rolled silently open. White was ushered inside, into the presence of Resident Protector Kilross.

Kilross was sitting down when White entered. He sat virtually enfolded in the soft moist arms of a relaxer, and as the gentle vibration of the chair traveled through the Protector's body the pink flesh of his throat and cheeks quivered perceptibly. He looked, thought White with some distaste, like a man who enjoys his comforts too well.

Without rising, Kilross gestured him to a seat—a straight-backed chair, White noticed gratefully, not a clinging relaxer. White had little sympathy for some of the effete customs of the native-born Earthers. He regarded Earthers, in general, as a soft lot.

But there was nothing soft about Kilross' voice as he said, "This visit is most unusual, isn't it, Mr. White? It was my impression that you preferred to keep aloof from such dreary things as affairs of government—and from such dreary people as those unfortunate ones who hold high government office."

White nodded stiffly. "It's not my aim to take part in affairs of state, Excellency. I feel my family's had more than its share of power in

Dannon's brief history, and that I should step aside."

"I understand perfectly," Kilross said. "I believe you made something of the same sort of speech the last time I saw you. Seven years ago, wasn't it, when I offered you the premiership and you refused it?"

Curtly White said, "Seventh of Sevenmonth, 3107. Odd how the sevens haunted us. But I didn't come here today to discuss my private feelings, Excellency."

"Naturally. Cigarette, Mr. White?"

White took it and flicked the igniting cap. It was an Earther cigarette, with a strange alien tang to it. It seemed mild, lacking in bite. He preferred the local brand of tobacco that grew in the blue-black soil of the southern farm-ranges.

At length he said, "I'm here on a matter of grave concern to Mr. Henderson and his cabinet. They asked me to represent them here today."

"I'm listening."

"I came to discuss Home Rule for Dannon's World," White said evenly.

There was an immediate change in the Protector's manner. He straightened up tensely, almost like some jungle beast that had been lounging sleepily in the noonday sun but now sensed the approach of danger. The heavy lids of the Protector's gray eyes drew back. Very abruptly there was nothing at all effete about Resident Protector Kilross.

"Just how are *you* involved in the Home Rule agitation, Mr. White?"

Stonily White said, "I agreed to bring a petition to you. I have it here, with me. Would you care to examine it?"

Without waiting for a reply he drew the petition from its portfolio and slipped it across the burnished desk toward the Protector. Kilross' fleshy lips pursed in a sort of smirk as he accepted the little booklet and lifted its green fabrikoid cover.

The room was silent for several minutes as the Protector skimmed through the document. Finally he looked up and said, "I've seen declarations like this before. Have you read it?"

White nodded. "It requests you to contact Earth and make the necessary arrangements for a change of status for Dannon's World."

"This is the fourth such petition I've received since Mr. Henderson took office," Kilross murmured gently. "He's persistent, at least."

"He's received no response to any of his petitions, Excellency. I don't know Henderson well, but I understand he's a rather impatient man."

"Quite."

Kilross slipped almost reluctantly from the grip of the relaxer and crossed the room to a slate-gray file cabinet. He touched a black stud; the cabinet sprang open. White saw him unseal an inner section and draw out several fabrikoid-bound portfolios.

"Contrary to public opinion, Mr. White, I don't throw these things

away. I file them." Kilross dumped them down on the desk and indicated with a gesture that White was to examine them.

White leafed through them hastily and glanced up at the Protector.

"These are the three previous petitions!"

"And now I have a fourth for my collection. And there will be a fifth and a sixth and no doubt a seventh. Our Mr. Henderson can't take *no* for an answer."

Kilross sat down again and stared squarely across the desk at White. "My main job is to keep law and order on your planet, but I'm also here as a committee of one to determine when you've reached the point of Home Rule. Obviously you have not gotten there yet. I told Mr. Henderson this when he submitted his first petition. Tell me, White: do you honestly believe Dannon's World deserves Home Rule status now?"

White nodded forcefully. "I do. And my father thought so, seven years ago. I happen to know he was planning to file such a petition just before his death."

"Ah," Kilross said. "That was seven years ago. Dannon's World has changed in seven years, and not necessarily for the best, either. I spoke of *now*."

"I think this petition should be forwarded to Earth—with a positive recommendation."

"No. Dannon's World isn't ready for Home Rule status yet."

"Is that final?"

"It is. And if the Henderson government should send me one, two, three, or thirty-three more of these little petitions, I'll be compelled to ignore them the way I've ignored the first four."

White rose suddenly. He wanted to reach out and smash the smug Earthman behind the desk. "There won't be any more petitions, Excellency."

"Oh?"

"I give you fair warning. Henderson's a ruthless man. He wants independence for Dannon's World in the worst way, and he wants it *now*, while he's in charge of things. If this petition isn't granted, you can expect a revolution."

The word hung in the air, ugly, naked, mingling with the bluish clouds of cigarette smoke that the precipitrons had failed to clear away.

Revolution.

A network of worlds radiated outward from Earth in gigantic bounds across the black quilt of the night. And on one of the farthest and newest of the colonies an old and familiar word was resounding.

Revolution.

"So," Kilross said, "either I grant you the Home Rule you don't deserve, or Henderson seizes it? How interesting. Suppose we wait and see. You can tell Mr. Henderson, if you care to, that I choose not to sign this latest petition. Now it's his turn to move."

White nodded. He stared at the bland, mild, well-tended face of the

plump Earthman, and rage flickered through him. He wanted to say, *Wake up, Protector Kilross! Wake up and act or Henderson will rip you out of your cozy residence and toss you outback to the wolves, and with you our chances of Home Rule for the next hundred years.* He wanted to shout, *Earth will put down the rebellion and we'll be under martial law for decades. All because you're too lazy to do what needs to be done!*

"Excellency," White said, choking back his anger, "I presume you'll send for Henderson right away—before he has time to do anything foolish?"

Kilross blinked thoughtfully. "I don't feel any need to speak to Mr. Henderson."

"Don't you see, if you could only calm him down somehow, keep him from doing anything rash. . . . Perhaps one word from you . . ."

"Mr. Henderson is the duly elected head of state on Dannon's World," Kilross said frostily. "He is free to act as he wishes within the bounds of his office. But I will not interfere until such time as he has actually exceeded those bounds, not before. Is that quite clear, Mr. White?"

White was silent for a moment, baffled and angry. A curve of events was taking shape, and he didn't like its implications.

I get it, he thought. *Give Henderson enough rope, let him rebel, and then hang him. But what about Dannon's World? We'll suffer. And you could prevent all this if you wanted to!*

In a rigidly calm voice he said, "I believe we've reached the end of this discussion, Excellency. I have nothing further to say. May I be excused?"

"You can go, White," the Protector said. With a casual flip of his hand he increased the vibrational intensity of his relaxer, while with his other hand he buzzed for the robot to show White out.

After the colonial had gone, Kilross nodded approvingly, smiling. He had plenty to tell when he rang Stoneham up on the solido for their next meeting. White had been hooked; he was free to wriggle, but the course of events from here on was fixed.

He's tough, all right, Kilross thought. *Tough and stubborn and smart. And before I'm through with him he'll hold the job he was meant to hold. But he still needs a little push—*

III

". . . Inexorable is the wheel of Zeus, and many a thing he brings to pass contrary to our expectation; that which we thought would be, is not accomplished, while for the unexpected, Zeus finds a way."

Andromache

Night had dropped by the time Austin White returned to his apartment; the two bright snow-faced moons of Dannon's World danced in the skies, and behind them the

hard speckles that were the stars gleamed profusely. Sometimes White liked to stare at them, wondering whether he was seeing the sun of Earth, but now he did not look up. He had phoned the Capitol to report on Kilross' reply, but his own involvement with the problem did not end there. He was a deeply angry individual just now. He seethed.

He was angry at Klein, first of all, for having dragged him into the situation in the first place. But he was angrier at Henderson, that cold-blooded, opportunistic idiot, and still angrier at that fatuous dandy, the Resident Protector Kilross.

White slipped a musicdisk into the player—a late Beethoven quartet, a thing of subtle textures and nuances—but his mind was too bound up in political considerations to allow him enjoyment. He could not follow Beethoven's intricate structural logic this time, and for some reason the pale-hued sound of the violins seemed whining, irritating, foolish to him. Angrily he snapped the machine off, thinking blackly of Kilross.

Kilross. A man with life tenure, an easygoing man, a lazy man, perhaps. This, thought White bitterly, is our Protector. This is the man chosen to dispense the age-old wisdom of the Mother World to the struggling benighted colonials.

Kilross was not stupid. He undoubtedly knew in full what the inevitable consequences of his action would be. A revolt, no doubt, and the Protector would find it necessary to call in the nearest wing of the Patrol to quiet matters down.

Dannon's World would swiftly and inevitably yield to the greater might of Earth—and the limited-rule constitution would be suspended; the world would revert to its original status as a territorial possession governed directly by distant Earth.

It was within Kilross' power to dissolve the Henderson government and order a new general election. Perhaps a moderate—Klein, maybe—would become Premier. Catastrophe could be averted. But, thought White, Kilross had simply washed his hands of the matter. He was going to sit back and wait, and see, and give Henderson enough rope.

There was a sour taste in White's mouth about the whole affair.

Dispiritedly he sank down on his chair and looked at the stacked papers on his desk. A binder was neatly labeled: "Notes Toward a Definition of Human Communications." Fifteen years of work, painstaking construction of a still incomplete system for calculating societal stress-patterns and balances. He had hoped to reach at least a tentative result by this time—but even limited success was at least a year away, possibly more. And within a year Henderson and Kilross between them would have so shattered the structure of society on Dannon's World that his work would have been rendered pointless.

He thought of his father and grandfather, the latter Dannon's first premier under the new constitution.

Magnificent statues of them, fashioned from glossy plastolex, stood before the Capitol. They had worked tirelessly toward attaining Home Rule and independence. They had built Dannon's World, outward from Dannon City, establishing the settlements of Chesley and Berrin and Dawnbreak, pushing back the rugged frontier of the planet, creating a representative assembly that really represented and really assembled. But they had been only political engineers, inspired tinkerers operating on guesswork, rule-of-thumb. Austin White had tried to search out theoretical ideals of governing practice.

And I failed. I didn't find my answer in time. And so rebellion, and generations of patient work undone in a fortnight of blood.

The visiphone chimed. White ignored it, but it rang insistently, and at last he stretched out a hand and flipped it on. The image-screen lit and out of the swirling yellow electronic haze came the face of Bernhard Klein. Klein looked strangely tense. Worried.

"There you are! I'm glad I found you at home. Austin, can you come down here right away? Without wasting a minute, I mean. I'm at the Capitol."

"I called there earlier today. I spoke to Henderson and told him what Kilross said. You know about it?"

"Yes, yes, of course," Klein chattered impatiently. "I know *all* about it. Henderson's furious! He's threatening to arrest Kilross and any Earth-sympathizers in Dannon City by morning, and proclaim independence."

Numbly White said, "I expected it. So what?"

"So what? *So what?* Look, Austin, I don't want to talk about this on the screen. Grab a monobus and come down here, right away."

"What do you need me for?"

"We're trying to calm Henderson down. We're trying to show him that it's suicide to start a rebellion against Earth—that it's impossible to win. He's determined, though. So we're calling up some of the prominent local citizens, to form a sort of committee to speak to him and make him change his mind. And we thought you . . ."

". . . Would like to come down here and help," White completed. "Sorry, Bernhard. No sale. Not interested. No go."

"But—"

"But nothing. Henderson doesn't need any calming down, and he won't listen anyway. He's calm and rational and he's planned this whole thing for months. And he'll go ahead with it no matter who comes downtown to pat his back and soothe his soul."

"That's a defeatist attitude," Klein chided.

"It's a sensible attitude. Henderson knows what he wants and he's blind to the consequences. I've wasted enough time and energy on your behalf today, Bernhard. I've

been neglecting my work. And now—"

Klein's eyes gazed reproachfully at him. "You just don't want any part of the whole mess, is that it? You can't be bothered. I'll bet your father's spinning like a turbine in his grave."

"That'll be enough," White snapped. "I don't see any point in trying to hold back the inevitable. I learned all about political dynamics first hand, growing up in the Capitol. I see what's coming. I can't stop it; therefore I shrug my shoulders and look the other way. Good night, Bernhard. Please don't call any more this evening."

He broke the contact; Klein's accusing face disappeared. But as White turned away from the screen he knew that he had neither been honest with Klein nor with himself.

He could not just shrug his shoulders and look away. A revolution was about to break, here in the city where he lived, and it would consume the planet he loved. He could not ignore that. The time was coming when he would have to choose between his work and his planet, and he dreaded that moment of decision. His work was important—but how important?

An oppressive and unfamiliar sense of impotence and futility settled over him. *You take an Earth-type world, diameter nine thousand miles, fourth out of eleven planets of a G-type sun. You put a few thousand Earthmen on it and let them breed, and you get a colony-world, population fifty million,*

ready to become a free and wealthy planet. Then along comes a lunatic like Henderson and a procrastinator like Kilross, and five generations of work goes for nothing.

He shook his head. Time to get down to the equations for ethical two-way flow of responsibility. He turned on the desk lamp and compelled himself to carry on with his work.

If Mark Henderson had not been the sort of man he was, Resident Protector Kilross would have had considerably greater difficulties in establishing his desired pattern of events on Dannon's World. Henderson was unique—for, in the four hundred years since the beginning of Earth's interstellar colonization program, no one before Mark Henderson had dared to challenge the authority of the mother world. Earth's word was law.

Henderson was the first. His was the proper personality-pattern, and he had entered the flow of history at precisely the right moment. He did not know that he had been groomed for his task by the man he regarded as his most troublesome enemy, Protector Kilross.

Physically Henderson was impressive—above-average in height, and big, though without the lean muscularity of Austin White. Henderson was a heavy-set, fleshy man, almost burly, with sleek black hair combed directly back from his broad forehead. He affected a small pointed beard as well. His voice was a commanding boom. He thought of himself as a natural leader.

He had one other asset which many leaders of men in the past had found most convenient: he was totally unscrupulous in achieving his ends.

It took him only an hour, the evening of the day on which Resident Protector Kilross had refused his fourth petition, to rid himself of Klein and the other troublesome fleas who plagued him. His course was clear; he had charted it months before.

When the last of his advisers had finally been packed away, Henderson rang for his robosecretary and ordered it to phone Protector Kilross.

The robot registered the order and said unobstrusively: "Sir, may I remind you that the time is past 2300 hours? Protector Kilross has left instructions at the main communication center that his number is never to be called after that hour."

Henderson nodded. "I'm aware of that. His instruction is hereby rescinded. Get Kilross on the line at once."

It took four minutes, minutes that Henderson spent in an acute state of impatience, staring at the mighty three-horned saurian skull, a hunting trophy of his, that leered down at him from the opposite wall of his office. He had planned this moment so long that the phrases came bubbling up unbidden to his tongue as he waited for the screen to light.

Finally Kilross appeared. He

looked sour and irritated. "What is it, Mr. Henderson?"

"I want confirmation of the fact that you've denied my petition for Home Rule once again."

"Confirmed." Kilross glared stonily out of the screen. "What of it?"

Henderson paused an instant, then said: "It's my duty to notify you, as a result, that effective at midnight tonight your office is suspended and you yourself are subject to immediate deportation."

The Protector merely smiled. "By whose authority do you make these loud noises, Mr. Henderson?"

"By the authority vested in me as Premier of the Independent World of Holman IV, otherwise known as Dannon's World. At midnight an act of severance takes effect which ends any relationship Dannon's World might once have had with the planet Earth. I'm filing full notice of this with the Colonial Council on Earth—along with a detailed explanation of the circumstances that force us to take such a drastic step."

"Indeed," drawled the Protector. "I'm sure the Council will be fascinated."

"I'm sure they will be," Henderson said grimly. "And I hope they have the good sense not to order troops out in an attempt to flatten us. We'll show them we know how to fight, if they do."

"Undoubtedly you will," agreed Kilross.

Henderson's eyes blazed. "You're mocking me, aren't you? Think you're so very superior, with all that pure Earth blood in your veins? I'll be glad to be rid of you, Kilross. I never liked you. And what's more, if Dannon's World had had a competent governor instead of a sniveler like you, we'd all still be loyal subjects of Earth!"

"I'm sorry you feel that way," Kilross said gravely. "I had no idea you liked me so little. Good night, Mr. Henderson. And may you sleep well."

IV

". . . Refusal to act is in itself a form of action, and often is more compelling and efficient in its effect than any amount of positively-directed output of energy. It is a delicate matter that calls for great self-discipline and foresight. The successful Protector must know when the interests of his world and of Earth will be best served by staying his hand, biding his time, and allowing the inexorable pattern to play itself out . . ."

Dynamics of the Colonial Process
Dawson

When Austin White woke the following morning after a hard night of work and a few hours of troubled sleep, he woke into a vastly altered world.

He did not need to go farther than the telefax slot in his kitchen wall to find that out. He rose at 0900, gobbled an anti-fatigue tablet, entered the kitchen, and yanked down on the actuating lever; the 'fax sheet came slithering out, and he scanned it rapidly, with a frown of anxiety and tension growing deeper on his face each minute.

The feature headline was:

HENDERSON DECLARES INDEPENDENCE

Premier Henderson had moved swiftly while Dannon City slept. Independence had been proclaimed at midnight, and Earth so notified by direct tight-beam subwave communication. Martial law was temporarily invoked. All members of the army reserve had been required to don uniform and report to their commanding officers for possible assignment. Meetings of the Representative Assembly were "temporarily suspended" by order of the Premier, until the present emergency state of affairs had become more stable.

Resident Protector Kilross had been declared an enemy of the state and he had fled during the night to the safety of the Terran Military Base near Chesley, at the mouth of the Brewster River, five hundred miles to the south. Many pro-Earth sympathizers had likewise escaped southward during the night. Premier Henderson had a brief statement in the 'fax concerning these people:

"I've given orders that they're not to be stopped. I'm not going to pursue a vindictive course. There are spaceships down there that can take a man off the planet, and anybody who wants to leave Dannon's World is free to do so. We want only patriots here."

White read through the rest of the paper in a state of dull shock and rising anger. He had known since the day before that the separation was inevitable; still, now that it had happened, it was hard to accept rationally.

Revolution.

On a planet that seven years ago had been content and happy, and grateful to Earth for the help the mother world had given it.

Of course, the worst was yet to come. Earth would never allow a colony to flaunt her strength this way. Soon—perhaps now—the golden-hulled Terran spaceships would descend on pillars of flame, the grim tight-lipped men in gray Terran uniforms would walk among the people of Dannon's World, if necessary shots would be fired. White shook his head angrily. How had a suicidal incompetent like Henderson ever been allowed to attain the Premiership? Surely anyone could see that defying Earth could only lead to prompt retribution.

But a power-hungry fool never sees past the end of his nose. Henderson had invited destruction; it was inevitable now. And innocent people would suffer.

In a way, White thought, *I'm responsible for this.* He knew that had he taken the premiership when it was offered, none of this would have happened. But there had been so many other men who seemed capable of keeping the government running more or less smoothly, and White knew that only he could have done the work he was engaged in. So he had moved to one side, making room for a Hen-

derson, and Henderson had seized the opportunity.

I guessed wrong.

He had turned down the job of an engineer to do that of a scientist, hoping none of the engineers would blow up the laboratory while he labored on developing the abstract theory of how to control explosions. The theory had not been ready in time; danger threatened. White stared thoughtfully at his fingertips, feeling an inner blaze of fury and the first faint tinges of what he reluctantly admitted was a feeling of guilt.

The planet of Lannimar, fourteen light-years from Dannon's World, was classed as a C-Rating world, only seventy-five per cent Earth-type on the Bryson scale. It was a small heavy-density planet with a 1.43 Earthnorm grav pull and a crust of heavy elements. That made it desirable for mining but rough on the miners, and Resident Protector Merrill Stoneham had to struggle not only against the aches of his own weary body and against the dark storms that whipped Lannimar's surface, but against the unruly, protesting spirits of the colonists.

Protector Stoneham was reviewing the Home Guard in a downpour, watching the drab uniforms go by while the bleak sky dumped buckets of water down. An aide approached, tapped him, murmured: "Sir, there's a solido call from Dannon's World. Should I tell them to call back?"

He shook his head; his forelock plastered itself to his brow. "No. Tell General Ayres that the review is canceled. I'll take the call in my office."

He stepped through the balcony window and into the room he used as his study. David Kilross was there already, in image at least, and he laughed as he saw Stoneham's bedraggled figure.

"Go ahead—laugh!" Stoneham growled. "You ought to try living on a world like this some time. Rain twenty-nine hours a day, gale winds ripping in off the ocean all the time, that damned bloated moon up there playing hob with the tides, the grav pulling you down—"

"I know," Kilross said. "You have it tough. I don't have anything else to worry me but a nice cozy little revolution."

Stoneham's jaw dropped. "A *revolution?* When . . . how . . . why—"

"Last night. I knew it was coming—in fact, you might say I manufactured it. The local premier booted me out of Dannon City. I'm in Chesley now; that's a spaceport city way to the south."

"Your *Extracts* article," Stoneham said. "You announced you were going to pull something like this, didn't you? Well? Are you in any danger?"

"Fortunately, no," Kilross returned. "I concluded a little deal with the revolutionary boss just before I left. I'm safe provided I get off the planet pretty soon."

Shivering, Stoneham shook himself dry. He grinned at the image

glowing lambently at the far side of the room. "You're not playing poker at the Academy now, Dave. You're juggling worlds. You're either a fool or a genius to try something like this."

"Probably a little of both," Kilross admitted cheerfully. "But I still think I'm holding all the aces—and maybe a fifth one up my sleeve."

The dull boom of thunder sounded behind Stoneham. He heard the howling of the native dogs, thick-bodied beasts the height of a man. Electricity seemed to crackle everlastingly in the atmosphere of Lannimar.

Stoneham smiled balefully. "You know best, I guess. Any time you get tired of playing Machiavelli, you can come visit Lannimar. I wouldn't mind a rest."

"Don't care for your weather," Kilross said, amiably. "But keep the offer open. I may need a place to hide out if things don't work out here."

That first morning after Henderson's coup, White offered the use of his apartment as a gathering-place for those of his friends who wanted to discuss the situation. The first of them arrived in midmorning: Kerry Burke, a rotund, usually cheerful abstract painter. But Burke was anything but cheerful now.

Some of White's other friends came while Burke was still standing in the doorway; by noon, seven members of White's little circle of acquaintances had gathered. They were worried. They sat in the mathematician's study toying with the drinks he had dialed for them, and tried to find something hopeful in the situation.

It was not easy.

"There's bound to be persecution," said gray-haired Gregory MacIntosh, Professor of Sociodynamics at the infant Dannon University. "Once Henderson has achieved full power he's sure to consolidate ranks, eliminate those who opposed him in the past and those who are likely to oppose him in the future. That means anyone who ever spoke out with liberal or pro-Earth sentiments. And that includes all of us."

"All except Austin," Burke said. "You never did commit yourself on any important public question, did you?"

"No," White admitted. "I never did, I suppose. But I don't think any of you ought to worry about possible persecution by Henderson. How long do you expect Henderson to stay in control, anyway? Why, Earth will smash this pitiful little insurrection in two or three days, and Henderson—"

"Henderson has all the time he needs to do his damage," interrupted Paul Gillison, who was the head editorial writer of the Dannon City telefax system. "I happened to do a little checking. There isn't an active Earth fleet within twenty light-years of here, at the moment. It'll take Earth at least a week to get a flotilla heading in this direction—maybe as much as a month! And that leaves

Henderson plenty of time for a Reign of Terror."

White frowned. "I didn't realize it would take so long. So you think Henderson's going to bring down the chopper, eh?"

"Immediately," MacIntosh said. "It's the inevitable pattern of a ruthless revolutionary. Henderson's a shrewd devil. He knows what happened to Robespierre and Danton, and he damned well intends to choke off the forces that might do the same thing to him. That moderate little speech in the morning telefax—you know, 'I'm not going to pursue a vindictive course'—that's a hint of what's to come."

"And what do you suggest *we* do about it?" Gillison asked. "Set up a counterrevolution and assassinate Henderson?"

MacIntosh shook his head. "A few of us are safe. Austin, for instance, really isn't involved in this at all. He's kept clear of politics. But you, Gillison, you and your editorials—that makes you a prime candidate for the graveyard. Burke, you signed that petition calling for a new election, didn't you? Then you're eligible for the axe, too." He looked around the room. "There isn't one of us who doesn't have some radical taint that Henderson could use as an excuse for getting rid of him. Except our host, that is. You're clear, Austin."

"Small cause for pride *that* is," White said darkly.

"Perhaps you're incriminating yourself by allowing us to enter your home today," Burke suggested. "If Henderson finds out, that is."

"I know what I'm going to do," said a deep voice from the far side of the room. It belonged to Merriam Rayner, a poet and teacher at the University. "I'm going to get out of Dannon City while the getting's good. There are spaceships at the Terran base near Chesley. I'll close down my home and get out of the system until Henderson's safely in check."

"You're likely not to find any home left, when you come back," MacIntosh warned. "The possibility of riots—"

"I have a wife and two children," Rayner said wearily. "They're more important to me than my home. I'm leaving for Chesley tonight, with them."

Gillison said, "I've just about made up my mind to do the same thing. It's suicide to stay here and try to oppose Henderson. And"—he chuckled hollowly—"I have a sort of phobia about committing suicide."

White glanced from one face to another, puzzled. These were the men who had been most outspoken against Henderson during normal times. But now that danger threatened they were packing up, getting out while they could, fleeing to safety. Somehow he had not expected them to do that.

"What about you?" White said to MacIntosh. "Will you be leaving too?"

The old man smiled wanly. "No,

Austin. I'll be staying here. I don't fear Henderson—and I think he can be beaten. If anyone remains to oppose him, that is."

"You're a brave man," Gillison said. "But it's foolish to try to stand up and fight Henderson. The Terran forces will be here to do that job in a week or two. Why not get out of the system until it's safe to come back?"

"Because I would never forgive myself for running away," MacIntosh said quietly.

White felt a surge of inner doubt. These were his friends; he wanted to help them. But some were fleeing, and the rest were foolhardily giving themselves up to certain imprisonment and possible death.

He knew that he himself was safe—for now, at least. There was no telling when Henderson might decide that White was a potential danger to him. In a reign of terror, everyone's neck is in jeopardy.

White decided he would face that problem when he came to it.

MacIntosh rose abruptly. "We'd better leave now. Some of us must go into hiding; the others will need to ready themselves for the journey. Austin—I hope to see you again."

"I hope so," White said.

He watched his friends file out, knowing bleakly that he was saying good-by to some of them for the last time.

V

". . . An opponent gifted with great physical strength is certainly formidable.

An opponent armed with dangerous weapons is similarly a cause for caution. But by far the deadliest of opponents is he who masks his true strength behind an appearance of outward sloth and cowardice. His is the mailed fist within the velvet glove; he may attain his ends by wheedling or by tantrums, or perhaps simply by arousing contempt for himself in the mind of his antagonist—but he will usually attain his ends. His great advantage is that his antagonist sometimes is not aware of the existence of conflict until he has already been defeated . . ."

Dynamics of the Colonial Process
Dawson

The arrests started the next day.

White learned about it from Bernhard Klein, who had fled to the suburbs and was trying to organize an opposition party. Klein called him on voice-alone, with image-screen blanked out.

"It's beginning, Austin. The persecution. They arrested Professor MacIntosh today."

White's jaw muscles stiffened. "What do you think Henderson will do to him?"

"Past tense: *has done.* They've probably held the execution already. I'm on the list, too. So are Gillison and Rayner and a lot of the others, but they're all safe. A ship left Chesley this morning with a load of fleeing liberals on board."

Moistening his lips, White said, "You're taking a risk in calling me, then."

"I know. But I had to talk to you."

"What are you going to do?"

"We're organizing a group. Trying to foment a counterrevolution. It'll take time, but we want to be ready when the Earth troops get here. They say it may be six weeks or more. I can't tell you exactly where we are now, of course, but if you're interested we'll get in touch with you. And we—"

The line abruptly went dead. White stared at the blank sleek grayness of the screen a moment, then dropped the receiver into the cradle.

Arrests. Executions. Here, on Dannon's World. And help was at least six weeks away.

The day slipped by, hour by dark hour. White ran some preliminary checks on the current segment of his work, but his heart was not in it. The equations lay lifeless on the page, mere fishhooks scrawled on white paper.

When things were going right, the numbers and symbols seemed to have lives of their own, dancing feverishly about while White followed their motion and pinned them down. He did not feel the frenzied excitement of his work this evening. He felt only gloom and bitterness.

His friends were gone. MacIntosh was probably dead; Gillison, Burke, Rayner and a few dozen others had fled to more congenial worlds. Bernhard Klein was a hunted fugitive.

I'm safe for a while, he thought. *But it's a hollow safety.*

Peace officers of Henderson's private army wandered the streets, preventing demonstrations and questioning all loiterers. A death-grip of tyranny had descended on Dannon

City in the name of martial law. Henderson was methodically choking out personal liberty to safeguard his grip on the premiership of the newly-declared-independent planet.

A thought occurred to White: if he died now, his work unfinished, humanity would suffer a great loss.

There was no immodesty in that thought, just objective thinking of a kind he had been trained to perform from birth. His work was potentially of infinite value to mankind—*if* he lived to complete his equations and finish his mathematical formulation of human communication. He owed it to humanity to stay alive.

He was going to have to leave Dannon's World.

He needed no rationalization. It was suicidal to stay and try to fight Henderson; the Terran forces would take care of that job soon enough. He had a responsibility to the universe, as it were, to get himself out of the danger zone and finish his work.

Once he realized that, the rest was easy. He packed quickly, taking just a few clothes, several books, and his working notebooks. He did not want to be hampered by even his few personal possessions now. After all, he would be coming back in a few weeks, when Henderson had been overthrown by the Terrans.

He traveled downtown to the jetline terminal. The peace officers questioned him, but made no attempt to interfere with him.

The terminal was crowded when he arrived; people seemed to be leaving Dannon City in flocks. It wasn't hard to understand that. White saw none of his friends in the crowd. Moving rapidly, he found the ticket booth for the evening jetliner southbound to Chesley, and waited his turn.

At the ticket window there was another delay while they checked his name and thumbprint against a master file held out of his range of vision. Evidently, despite Henderson's magnanimous proclamation that those who wanted to leave could leave, there was a list of traitors who were to be apprehended if they made any attempt to depart from Dannon City. White waited tensely.

At length the clerk looked up and said, "My apologies, Mr. White. Your name isn't on the restricted-travel list. You're free to go."

Without comment White paid for and received his ticket. He moved on through the passenger waiting room to the ready liner, and boarded it. He looked back, once; night was falling over Dannon City, and the massive vaulted bulk of the Capitol glinted blood-red in the double moonlight.

It was hard for him to believe that something like this could be happening on his world. Somehow none of his equation, none of his studies of political dynamics, had prepared him for such an occurrence.

For the first time in his life he felt profoundly dissatisfied with himself. He wished he could have undone the last three years. *The equations could*

have waited. They've waited through ten thousand years of human history. Dannon's World needed me, and I didn't come through.

But there was one ironic consolation: no one would ever ask him to take part in the government again, after Henderson's overthrow. There would *be* no government. There would simply be a Terran Administrator, as in any unruly or undeveloped colony which was considered unfit to govern itself.

The spaceport at the southern city of Chesley had been built in the early years of the colony by Terran military engineers, and the spaceport's chief uses were military ones. It was manned by a skeleton force of Terrans who were under the direct orders, not of the local government, but of the Resident Protector. The port served chiefly as a refueling base for Earth spaceships making long galactic hops.

In recent years the Protector had decided to throw the base open to development by several commercial spacelines, and it had become the chief departure-point for short-run journeys within the immediate galactic sector. Shortly after his arrival in Chesley, Austin White discovered that Premier Henderson had nationalized the commercial spacelines as part of his independence decree. Under the new regime, everyone boarding an extrasolar spaceship underwent careful screening first.

White was in the process of applying for a second-class passage on the liner *Victorious,* bound out the following day for the neighboring system of Montgomery, when a familiar voice behind him said:

"Leaving, Mr. White?"

Surprised, White turned. His eyes widened in astonishment as he saw who it was that had spoken. For a moment he was too stunned to speak. Finally, in a hoarse voice, he said, "What . . . what are *you* doing here, Kilross?"

The deposed Resident Protector had changed somewhat in the four days since White had last seen him. He looked older, now, and somewhat disheveled; he wore gray diplomatic clothes and a rather tattered red plastifab vest. But when he smiled, it was with all his old self-assurance and aplomb.

"I've taken up residence in Chesley since . . . ah . . . the unfortunate events in the capital city, Mr. White. But you haven't answered my question: Are you leaving?"

Stiffly White said, "I am. Temporarily, that is. Until conditions return to normal."

"You mean, in other words, until Mr. Henderson is removed from power?" Kilross asked smoothly.

White nodded at the Earthman. "Bluntly, yes."

A curious expression of surprise mingled with amusement crossed the ex-Protector's face for an instant. Gently he said, "If that's what you're waiting for, I'd advise you not to buy a round-trip ticket."

"What do you mean by that?"

Kilross gestured gracefully to an

open-air café situated at the extreme right-hand end of the spaceport arcade.

"If you'd care to break off your ticket negotiations and have lunch with me," he said, "I'd be delighted to explain."

"All right. Let's go eat. But remember: I want explanations."

They crossed the broad, well-paved area to the café, which was crowded with hungry travelers. They found seats, beckoned to a servo-waiter, and punched out their order from the menu on the robot's chest.

"It's very simple," Kilross began, as they ate. "I'm here in Chesley on a safe-conduct pass granted by Premier Henderson."

"But I thought Henderson had issued orders for your arrest."

"He did, he did. But that was a long time ago," Kilross said. "Two days is a long time when a revolution is going on. Those orders have been withdrawn. I'm merely waiting until next Twoday, when a Diplomatic Corps ship is scheduled to arrive and pick me up for my trip back to Earth. Henderson has granted me the freedom of Chesley until my departure time."

White blinked. "Let me get this straight—is there some deal between you and Henderson?"

"*Deal?* An ugly word, Mr. White. I have simply agreed, at last, to sign Mr. Henderson's petition for Home Rule status. I'm adding a full recommendation to the Colonial Council that such status be granted. Such a recommendation is never denied; and so, since there's no longer any need for a Resident Protector on Dannon's World, I'll be leaving next Twoday."

White was silent a long moment as the picture swirled crazily around him and then jounced into place. Somehow, he realized, he should have expected something like this—but he had never really believed that Kilross was capable of such a thing.

He jabbed a finger at the pudgy little diplomat. "So you stalled and bungled around until Henderson was able to grab power, and then you sold out to him! You mean to sit there and tell me that you recommended Home Rule just to save your own sweet-smelling skin, after turning it down so long because you did not think we merited it?"

"Yes," said Kilross blandly.

A bead of cold perspiration dribbled down the side of White's neck. He was no longer hungry; the thought of eating a meal at the same table with the Earthman was revolting.

"So there won't be any punitive force coming from Earth," White said at last. "Instead, Earth—as represented by you—is simply drawing back and tossing Dannon's World to Henderson for keeps. Is that right?"

Kilross shrugged. "You put it crudely, Mr. White."

"I don't care how I put it! It's the truth! You're all a bunch of fat-bellied cowards, and you're taking

the easy way out by giving up! Why, I ought to—"

Kilross raised one hand in protection.

"May I remind you that Mr. Henderson has guaranteed me safe conduct? I'll ask you to keep your hands to yourself, White. And," he added, his voice darkening, "I don't think you're precisely the person to talk about taking the easy way out of things."

White's jaw dropped in amazement; a couple of strangled syllables came from his mouth, nothing more. He pushed back his chair, rose, stared down angrily at Kilross for an instant. He had never felt such hatred for a person before. Restraining himself, he spun and walked rapidly away.

VI

". . . Values conflict constantly. It is not easy to evaluate one's actions without external referent points. One may firmly—and sincerely—believe that one's actions are beneficial to humanity, and yet unknowingly one may be functioning in a directly negative manner. One task of the Protector is to aid in avoiding such confusion of values . . ."

Dynamics of the Colonial Process
Dawson

The hot southerly sun was coming down hard; Austin White walked round the roomy spaceport until his feet ached and his body was soaked with sweat, while he tried to think things out.

It took him nearly an hour to get calmed down after his brief talk with Kilross. He knew he could easily have killed the Earther at the table if he had only a little less self-control.

But once he was calm, it took him only a few seconds to make up his mind about his next step. The situation no longer allowed inward debate, pious intellectual weighing of balances, if-ing and but-ing. There was only one path open to Austin White.

He had to remain on Dannon's World and fight Henderson himself.

All his plans for taking refuge on Montgomery VII had been predicated on the expectation that Kilross would call in a Terran force to put down the Henderson rebellion. But Kilross had sold out. There would be no Terran force. Henderson would rule unchecked. Unless—

White saw clearly that it would be cowardice to leave Dannon's World now. He, and he alone, could take the necessary action. His equations for human communications would simply have to wait, now, for some less troubled time, for someone else's hand.

There was no doubt in his mind. He was the son of his father and the grandson of his grandfather, and duty and service to humanity were concepts engrained so deeply in the texture of his personality that he took them for granted. He bought a ticket for the next jetliner back to Dannon City.

It was scheduled to leave in half an hour. He went to the locker where he had stored his suitcase and re-

deemed it. He boarded the liner about fifteen minutes before departure time.

Fifteen minutes later, he was on his way north. He spent the seventy minutes of the trip working out his plan of action. He smiled to himself as his pattern formed. Perhaps he hadn't been able to complete his equations, but he knew enough of psychology and power dynamics to manage by ear well enough, without benefit of the scientific formulation.

It was late afternoon when he reached the Dannon City Jet Terminal. He boarded a local monobus and traveled downtown to his flat. There, he paused a moment before the visiphone, then dialed the number of the Secretary to the Premier. A pulse thundered inside him.

The screen lit. A dark-bearded, nervous-looking individual said, "Office of the Premier. Who is calling, please?"

"My name is Austin White."

"Yes, of course, Mr. White. What can I do for you?"

White moistened his lips thoughtfully. He said, "I'd like to make an appointment to see Premier Henderson, if it's possible. For the earliest time at which he happens to be available."

The secretary's face left camera range for a moment. He seemed to be consulting a memorandum book. At length he said, "I'll have to check with Mr. Henderson. Will you wait?"

"Of course."

The screen blanked as the secretary switched lines. A minute went by, and another. Finally the screen came to life again and the secretary, looking somewhat perturbed, said, "Mr. Henderson has informed me he can see you immediately, if you'd like to come down to the Capitol this afternoon."

"That'll be fine," White said.

Austin White knew the Capitol as well as he knew his own home. His earliest memories included being taken to visit his grandfather, Premier Harrison White, solemn-looking, fantastically tall and old, in the Capitol's quiet rooms. Then his grandfather had died; White cast his memory back more than thirty years and glimpsed again the impressive funeral service that had been held for the old man.

After that his father had taken the premiership, and the Capitol became a familiar haunt for young Austin. He had been a great favorite among the Assemblymen, he remembered. He realized now that they had simply been currying favor with him to further their own ends, since it was assumed by all that Austin would some day hold the office held by his father and grandfather.

But there had been the quarrel with his father when he was in his early twenties. White remembered snapping angrily, "You don't know how to run this world! The people love you, but you're a phony! You bluff and wiggle and give in to expediency, and somehow civilization

stays in one piece, so they call you a great administrator. Take it from me, Dad, you're a fraud."

Richardson White had not grown angry. He had simply smiled—smugly, young Austin had thought, but perhaps it was a wise smile—and said, "Would *you* like to try my job for a while? I could step down in your favor if you like."

"Me?" Austin exploded hotly. "Me? I don't want your job! I'll never set foot in this building again."

And then he told his father the bright dream that had been growing within him: "I'll do basic research, instead. I'll discover the fundamental principles of governing. Develop mathematical expressions for human relationships, pin down concrete terms for these vague abstractions. And when I've done that—not before—I'll take the premiership."

"You may wait a long time," his father had said.

Since that day, White had kept his word; he had never entered the Capitol again, even though his anger toward his father had cooled into a more understanding compassion for the older man's handicaps. He had simply never had the occasion, in his father's last years, to go near any of the governmental buildings, and in the seven years since his father's death he had been far too busy with his work to have opportunity to enter them.

But now he was returning. His father had been right, and he had been wrong.

Guards in the uniform of peace officers stood at the entrance to the Capitol now. They methodically searched White before passing him on.

An undersecretary met him within the gate and conveyed him past what was undoubtedly an electronic scanner to an inner room, where Henderson's nervous-looking secretary met them. White nodded at the man.

"Mr. Henderson is waiting to see you," he was told.

"I'm anxious to see him, too."

But it was necessary to pass another scanner and a second battery of watchful guards before he was finally admitted into the presence of the Premier himself. White got the impression that Premier Henderson was a badly worried man.

If that were the case, though, it hardly showed on his face. White was eventually ushered into the luxurious study in the Premier's suite, and there he found Henderson beaming confidently at him.

The Premier rose, crossed the room, and seized White's hand. They were virtually of the same height, both of them well over six feet, but because of his fleshiness Henderson outweighed White by nearly thirty pounds. He wore the ceremonial costume of state, which startled White; he recalled his father's aversion to wearing the gaudy thing except on the highest state occasions, and it was strange to see Henderson clad in it now.

"I've been hoping you'd come

down to see me, Austin—you don't mind if I call you Austin, do you?"

"Not at all—Mark."

"Have a seat, won't you? Drink? Smoke?" There was a note of forced, almost desperate geniality in Henderson's tone.

White made himself comfortable, while Henderson bustled around the office. "You must really feel at home in this place, eh?" Henderson asked. "Being practically raised in it, so to speak."

White chuckled. "It does look familiar. But I've been away from it a long time."

He looked closely at Henderson. The Premier was attempting to radiate hearty good cheer, but there were telltale signs of a more tense inner state. His dark eyes flickered nervously. He seemed ill at ease. Inwardly White rejoiced.

Henderson sat down behind the big desk, facing White. "I don't know why you've come to see me tonight, Austin—but I want to tell you that I'm glad you did. I feel we should have gotten together long ago. Last week—when you stopped off next door at the Ministry of State to pick up that petition—I wanted to get the chance to talk to you. But things were so hectic then."

"Yes, they were," White agreed wryly.

"They've calmed down now. I suppose you've heard that Kilross gave in and signed my petition."

White nodded. "They broadcast it over the public-address system on the jetliner I was on this afternoon."

Henderson frowned. "Jetliner?"

"I went down to Chesley," White explained. "I . . . thought I might take a little trip offplanet. But then I changed my mind and decided to come back to Dannon City." He eyed Henderson carefully, and, weighing his words with much thought, said, "I believe you've done a grand job, Mark. I . . . I wondered if there was anything I could do personally to help you in your work of making Dannon's World independent."

They were difficult words to say, but they rolled off White's tongue with an inborn ease. His father had always said, *Know when to lie and know how to lie.* This was the time for lies.

Henderson grinned appreciatively. "I'm glad to hear you talking like that, Austin. You don't know how much the support of a White means to me and my program."

To me and my program, White noted. *In that order of importance.*

Aloud he said, "You know, I've never really done my fair share as a citizen before this, Mark. I . . . well, I felt that my dad and granddad had done more than their share for Dannon's World, and that I could coast on their laurels. But I see that I've been wrong. I came to offer my support. If there's any way I can help—"

Henderson seemed positively beside himself with gratitude. "I've had a tough time of it, Austin. A liberator always has to struggle against the conservative elements in his following, the dead weight.

There are so many *big* things I want to do, once I'm sure of a unanimous backing—and having you, with all the great traditions of your family, as a member of my cabinet—you *will* take a cabinet post, won't you?"

White made a token show of reluctance over the offer of the cabinet post. Then he nodded diffidently. In that moment Henderson's doom was sealed.

"Yes," White said. "Yes, Mark. I feel it's my duty as a citizen to accept your offer!"

VII

". . . Water inevitably flows downhill. A critical mass of U-235 will invariably detonate. And, also, though a natural leader may for one reason or another be unwilling to take the responsibility that is rightfully his, once it has been demonstrated to him that he must assume responsibility he will inevitably forge his way to the top, sweeping away any obstacles that block the path of human—and his own—progress . . ."

Dynamics of the Colonial Process
Dawson

Six months had passed. *A busy six months, too,* Austin White thought tiredly, thinking back over the time that had passed since his visit to Premier Henderson—to the *late* Premier Henderson. White stared at his face in his office mirror and saw lines of exhaustion ringing his eyes. He had never known that the premiership could be so much work.

Most of it had been drudgery, as he had expected. He was not used to doing drudgery. He had never really done "work" in his life, defining work as something done because it had to be done whether you liked it or not or whether or not you had something else you thought was more important to do. By that standard, his unfinished labors on communication theory had been sheer play.

His rise to power had not been easy. Subverting the Capitol guards had been hard. Many of them were fanatically loyal to Henderson; White had had to seek out those few who had been appointed in the days when his father had been premier, and approach them cautiously. It was delicate work—especially considering that he was carrying on a full-time job as Minister of Information as well.

But success had come at last. It was the grievous task of a shocked Minister of Information to announce to the people that their beloved premier had been taken from them in the height of his strength, with his work left unfinished. It was with the greatest reluctance that Austin White allowed the Representative Assembly to name him as Henderson's successor.

"I hesitate to take on this great burden," he told them. "I know from the experience of my own family how terrible a task it is, and I fear that my own feeble abilities will fall far short of the requirements."

Naturally, as he expected, they shouted him down; that night, he moved into the Capitol to stay.

There were little details to be attended to, such as paying off the assassin and then making sure the man got as far from Dannon's World as possible. These things out of the way, White began the job of knitting together the fabric of society where his late predecessor had ripped it apart.

The exiles returned from the far planets at White's request. The security police was rapidly disbanded. Some of the more fanatical Henderson followers had to be placated with important-sounding but functionless government posts, to keep them quiet.

It was taxing work. It meant completely abandoning, for the time being, what Austin White had considered his life's work. His notebooks gathered dust in his office; his equations remained incomplete. But he had no time to regret that fact. He was constantly busy with the job of governing—and he enjoyed it!

No word came from Earth. Kilross had vanished, and no vestige of Terran authority remained on Dannon's World. White governed as if the planet had been granted Home Rule privileges. A deal had been arranged between Kilross and Henderson, though neither of them was on the scene now.

White had a visitor at the beginning of his sixth month in office. He was signing official documents at the time; the visiphone chimed

and he looked up to see his secretary's bewildered face in the screen.

"Sir, there's a man here to see you, but he won't give his name. Says you'd be interested in talking to him. We scanned him and he's not carrying anything dangerous."

"Let me see his face."

The camera swiveled and White found himself peering at a countenance that was oddly familiar but which he could not place. He frowned. Then recognition dawned, and he nodded.

"All right. Send him in."

A few moments later his office door opened. A short, slim figure entered, smiled, and said softly, "Good cheer, Premier White."

"I thought you had left this planet months ago. What are you doing here, Kilross?"

"A long story," the Earthman said. "Won't you invite me to have a seat?"

Kilross had changed enormously. Gone was the citified pudginess that had characterized his appearance before; he seemed to have lost thirty or forty pounds, and he had none of the pink chubbiness he had had when Protector. His face had hardened, his lips had grown thin, his eyes had become more deeply set in their sockets. He had grown a beard, stiff and neatly trimmed.

"You're sitting, now," White pointed out coolly. "Why have you come here?"

"To congratulate you, Premier White."

"I don't need any congratulations from *you*, thanks."

"Maybe not. But you *do* need a good tongue-lashing, and I figure this is the best time and place for applying it. Sit still and listen to me, White."

"I'm busy," White snapped irritably. "No time for foolishness. Why have you come back to Dannon's World?"

"I never left it," Kilross said.

"What?"

"I've been . . . ah . . . incognito. But I've been keeping up with current events. Sad, wasn't it, Henderson dying like that? So young, too. And I see you had to twist your own arm to take the premiership. That was good. It's a credit in your favor when I file my report next month."

"May I ask what the blazes you're talking about? *What* report?"

"The report on the six-month trial of Home Rule here. A successful trial. I was pretty sure that once you got pushed into taking over the premiership, Dannon's World was over the worst of its troubles. The trick was to push you, you nearsighted nincompoop!" He cut off an outburst from White by adding, "I must say you did a marvelous job of getting rid of Henderson."

"How do you know anything about—"

"Because I arranged it," Kilross said suddenly, in a new voice that crackled with strength. The Earthman rose and paced around the room. He suddenly seemed an oddly

commanding figure, with none of his earlier effeteness.

"Some men," the Terran said, "are born to rule. Others grab power. And still others, to complete the paraphrase, have to have power thrust upon them. You're in the first category, White—you were virtually *bred* for the job, you know. But you deliberately placed yourself in the third category. There were times I could have cheerfully strangled you, if you weren't so important. You made things tough for me by refusing the premiership."

"I had other goals in mind. Ultimately the same goals. I was working on—"

"I knew what you were working on. Hogwash!"

"What? I—"

"For a while I was hoping you'd actually get somewhere with those equations of yours. But then Bernhard Klein told me you figured you needed ten more years to reach a first-order conclusion, and I knew you were way off the track. The blowup on Dannon's World was coming a lot faster than that. If your equations—unfinished as they were—couldn't tell you that much, they weren't worth the ink you scrawled them in."

White reddened. He said nothing.

Kilross went on. "You were up in an ivory tower and getting farther and farther away from the bitter reality right in front of your nose. So I decided to drag you out and show you what your equations couldn't seem to tell you. I found Henderson and gave him the itch to run things—an itch that was latent in him anyway. I egged him on by hinting about Home Rule, and made him sore by ignoring all his petitions. I nudged him along the path of rebellion for two years.

"Then I began yielding to him, hoping all the time that you'd wake up before it was too late, and see what you had to do. But you stuck to your work. You insisted on being a sicentist at a time when this planet needed an engineer, a man who could get down in the grease and muck, and figure out just what in blazes was *wrong*.

"Finally I tossed control completely into Henderson's hands by my Home Rule sellout. That left it smack up to you. If you hadn't acted inside of a month, a Terran task force would have landed here, booted Henderson out, and set up permanent occupation quarters. But I knew you'd come through. I made a bet with myself that you would."

He looked at White sharply and in a mild voice said, "Would you mind answering a couple of questions?"

"Sure."

"You were working on an equation for human communication, weren't you?"

White nodded.

"And presumably you had done a lot of work. Enough so your equations could give you insight into prevailing currents of action."

"Yes."

"Uh-huh. And therefore you knew exactly what was going to happen, because your equations told you: that Henderson would rebel, that Earth would smash the rebellion, that Dannon's World would be blacklisted by Earth and ticketed for direct administration for the next five hundred years. And therefore you sat back and let it happen, eh?"

White fumbled for words. "No, it wasn't like that at all. I mean—" He paused.

Levelly Kilross said, "You mean that your equations told you Henderson would successfully resist Earth and put up a permanent dictatorship here? Is that what you learned?"

"No, it isn't that either. I . . . I—"

There was nothing he could say. He felt his cheeks growing hot. Inexorably Kilross went on in the same quiet, easygoing tone: "Either way, you knew the result was no good for Dannon's World. If Henderson won, freedom was finished here. If Earth had to step in, Dannon's World had forfeited its right to Home Rule by sitting back and letting Momma clean up the mess. And so, since you foresaw all this with the aid of your equations, you took the best course of all: shut your eyes, crossed your fingers, and wished on a star that everything would come out all right. No? Yes?"

Kilross had not raised his voice once, and yet White felt as if he'd been through a meatgrinder. All the inconsistencies and evasions of his behavior sat accusingly out in the open, and there wasn't a blessed thing he could say in his own defense.

He had been raked over the coals by an expert.

There was silence in the room now. Kilross walked to the bar, and without waiting for an invitation, dialed himself a stiff drink. White sat numbly hoping he wasn't going to continue in the same vein as before.

The worst of it was that the little Earthman was uttterly, damnably right. White saw now that he had sought Information, in capital letters—but Information wasn't Understanding unless you could make it work in a real-world situation. And he couldn't.

"One of the main troubles," Kilross said, "was that this world was too nice. I have a pal a dozen or so light-years away who's on a world that's hell to four decimal places. The settlers there don't wallow around dreamily; they wouldn't live long if they did. But here—the only force you had to fight was yourself. Dannon's World is so Earthlike that it doesn't provide much of a challenge—and most of the settlers were content to sit around and let Earth put things to rights. *You* were the man who could dig down into the mess here and clean things up—but I had to pry you out of that damned ivory tower first. Pure symbols can't solve problems unless someone's willing to do the dirty work of applying them."

"And my symbols were cockeyed anyway."

"More's the pity. We desperately need the kind of formulation you thought you were creating. But we need independent planets more, and quicker. Sure, your work might have been valuable. If it was valid. Was it?"

"I guess not," White said.

"Damned right you guess not! So I made you scrap it and start all over."

It would have been funny, except that White felt too humiliated to laugh. Kilross was a cold-blooded engineer, on a planetary scale—giving him what-for beautifully!

The Earthman gulped the rest of his drink and said, "I'm going now. I have work waiting for me elsewhere. Look, friend—remember this, huh? *If it doesn't work, scrap it and start again.* Call that a basic axiom of human progress, or just a rule of thumb. But remember it."

White nodded. He felt very small just now, but somehow he didn't resent what Kilross had done. You couldn't resent the truth very long.

He had fouled up. Somewhere he had gone off the track, and Kilross had painstakingly—and most painfully—dumped him back between the rails, nudging him along like a small and not too bright child. Well, he had learned the lesson for today, and he found himself wishing Kilross would remove himself. The time had come for him to glue himself together, to put back the fragments of the personality the Earthman had just dismembered so efficiently, and get down to work.

At the moment, he felt a surge of respect and admiration for the Earthman—a somewhat painful sense of respect since it involved his recognition of the deep and basic blundering in his own work.

"I think I need a drink," he sighed. He dialed with exaggerated care, then set the golden drink down untasted on the edge of the desk. He looked at Kilross.

"Was it necessary to make me hate you?"

Kilross snorted. "You were living so damned impersonally, so beautifully theoretically, that that was the only way to reach you—you had to get a personal, immediate, here-now, practical-living reaction of some kind through that theoretical fog of yours.

"You have the talent—and it's an artist's talent, not a scientific thing that men can be trained in!—to run this world the way it needs to run. Your equations would make it a science—if you had equations that actually worked.

"We—the human race—can't allow you to waste your time. If you need insulting before you can be jolted into working—you'll get it. If you need a personal hate—we'll give you that.

"You're doing a fine job. Stick on that job—and work out equations that *work*. We need 'em, and need 'em bad. I haven't got what it takes to develop them—you have. But you

can't do it without remembering that basic principle: No idea is a good idea if it doesn't work.

"I've got to go—I have another assignment, of course. Good luck, friend—and remember to have the sense to know it *is* luck. None of us knows enough to do more than gamble in this business. Start kidding yourself that you *know,* when you're actually gambling—and you'll be in your ivory tower again."

White picked up his drink slowly, paused, and looked across it at Kilross. With a wry smile, he shook his head slightly. "Not with you around the galaxy. But I'll try not to make it necessary to have Momma Earth clean up our mess again. The worst of it all is . . . I realize now that Dannon's World still has not earned Home Rule, really.

"You're right that we obviously wouldn't have merited it if we couldn't clean up our own troubles—if we sat and waited for Earth to bail us out of our self-caused debacle.

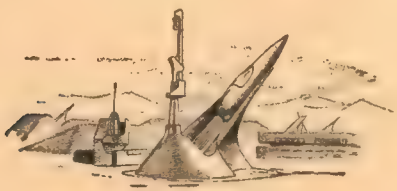
"But . . . oh, dammit, Earth *did* bail us out! You had to drag me out of my . . . hideaway."

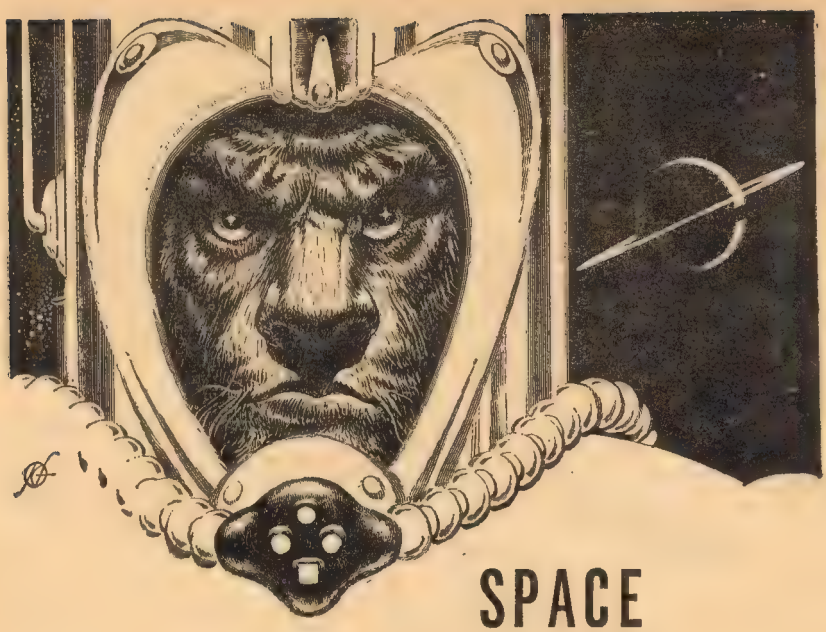
Kilross' face lit up with a broad smile. "Hey, I win! Stoneham swore you'd never spot *that* angle! Thanks! You just won me a hundred on that bet!"

White was still standing somewhat openmouthed as Kilross went out the doorway. Gradually it dawned on him that his own recognition of that fact made it permanently impossible for him, with his basic desire for self-honesty, to resign from this job that he so little wanted—either by direct resignation, or by default, as he had for so many years.

A slow, burning mixture of resentment rose in him. Kilross had most thoroughly forced him to trap himself—and the most infuriating thing about it, of course, was the bitter awareness that he'd trapped himself in truth. He didn't even have the satisfaction of feeling he had any right to be angry at that scheming, conniving, frustrating, hard-headed Earthman who'd done it to him.

THE END





SPACE TO SWING A CAT

It was a long, long time ago that Man learned that a horse can run and pull better than he, and that a dog can hunt better. Been quite a while since we've learned anything new....

BY STANLEY MULLEN

Illustrated by Freas

IN SPACE, the big ship and the little ship huddled together. Arnold Brook crawled through the flexible tunnel connecting to the air lock of the tiny spacer. Inside, Brook closed the outer valve and signaled he was coming through. A buzzer sounded, the red blinker went on, and the inner valve clicked, sliding slowly open. Evidently the new fish was already on-ship.

As chief test pilot, Brook had reached the stage of estimating in advance his chances with each new apprentice. His duties included testing new men or surrogates as well as ships. He wondered what the new boy would be like, or would this one be another Pilot Surrogate Number-something-or-other? Biolabs had been sending some weirdies lately.

His first sight of Tam, seated arrogantly in the triple-hung pilot's seat playing with the controls, convinced Brook that he was going to have trouble with this one. Tam—P. S. 97C—was a dilly. Becoming instinctively aware of Brook's scrutiny, Tam spun about and transfixed the veteran pilot with a pair of sharply alert yellow-green eyes.

"You're Brook, aren't you? Specialist test-pilot STP 471863H. I've memorized your records."

Brook laughed grimly. "Good. Then you'll know what to expect in the way of a shakedown. I'm tough on apprentices. It keeps them and me alive."

"It has until now," said Tam steadily. "You've never had a fatal accident with an apprentice, have you?"

"Never."

"And you've never given a Pilot Surrogate any kind of passing grade, either?"

"None so far. Maybe I'm harder to please with freaks."

"Controlled mutants, please."

"Man-made freaks," corrected Brook amiably.

"I won't argue with you. I just want to be sure that we understand one another," Tam went on seriously.

"I'm afraid we do," countered Brook, less amiably. "I didn't ask for this job, you know. It was dumped on me. I don't have to like it, and I don't have to like the material they send me. Human apprentices are bad enough, but I won't settle for any substitutes unless they're better than the original."

"I didn't ask for the job either," Tam stated fairly. "I can do the work, but I doubt if I will when people feel about me . . . about us, the way you seem to."

"I could be clearer."

Tam stroked a whisker with a beautifully formed finger. "Go ahead," he prodded. "I'm curious. What do you really think of us?"

Brook was irritated or he would never have said it. "I think you're a bunch of stinking animals. I'm just the cage-sweeper in a zoo."

"Unfortunately," muttered Tam, "the olfactory senses of other animals is more sensitive than in humans. And the stench of man has been an offense in our nostrils ever since the

gray apes descended from trees."

Brook had the grace to laugh, which eased the tension slightly.

"I apologize for my rudeness," Brook said awkwardly. "I should not have said what I did. And don't let it worry you as far as the test is concerned. You'll get a fair test."

"But you really don't like me?" persisted Tam.

"Let's say I don't like cats. Now that we've settled the relationship between man and the noble beasts which may or may not be his friends, shall we get to work?"

"Whenever you say," agreed Tam eagerly.

"Right. The first thing you have to do is relax. You may as well climb out of that seat and take it easy. Sleep if you can. They'll drop us off in seven hours—2300 Earth Arbitrary Time—and then you'll take over and run course. And remember, nothing is ever as bad as you feared, or as good as you hoped. You'll never run into anything in normal space-piloting as bad as the measured course. Most work in space is eternal boredom or screaming and continuous emergency. Anybody can stand boredom, so all you'll get in the test is emergency."

"Nothing is ever as bad as you feared, or as good as you hoped," Tam repeated aloud. "That's an awfully gray view of existence."

"Is it? I suppose you prefer bright colors."

Tam laughed. "With me, bright colors are standard equipment."

Tam yawned tigerishly, exposing savage fangs. His peach-fuzzed skin rippled smoothly as he flexed magnificent muscles getting out of the pilot's chair, which was actually more of a cage.

Out of the cage-seat, standing on hind legs, Tam stood taller than a man. His build suggested that he could walk erect or go as a quadruped with equal ease. He walked with pride, seemed alert and intelligent, not given to wasted thought of movement. In him was a natural pride of being which showed in his poise and a catlike grace and sureness of movement. He slipped down the trapeze bars of the ship's framing with the skill and agility of a veteran spaceman. Cat of the catwalks, thought Brook irritably. He looks like a tiger left too long in the rain, bright colors just starting to run together on the fine fur of his coat.

Tam was a cat. A tiger, to be strictly accurate.

In his profession, Brook had expected to catch a few tigers by the tail, but not so literally. Deep space is no place for such strenuous exercise. But science must be served, and the Biolabs were serving their science in pretty big platefuls. Tam was a new-model tiger, and even a tame tiger can be a husky handful in space. Biolabs might be, but Brook was not too sure that Tam was tame. The space-testing course would give him an excellent opportunity to find out . . .

Long ago, interplanetary expansion reaching as far as Pluto con-

vinced man of one thing. Before risking the black and empty unknowns beyond the Solar System, man would need a partner with greater strength, endurance, and quicker reflexes than his own. Machines could not completely fill the need. Devices such as mass detectors, proximity alarms and radiation counters could extend man's meager senses. Automatic calculators could solve problems of logic and astrogation more rapidly than man ever had. But there were limits beyond which mechanical extensions of his faculties could not serve.

Emergencies in space occur too rapidly for mankind's reflexes to function, and even robot piloting equipment was too unreliable and subject to breakdown. The race needed outside help, a partner, preferably an organic adaptation with high intelligence potential, yet with reflexes not atrophied by civilization. Only such a being could relieve man of the physical strains and crushing responsibility during microsecond emergencies in space. It must be a helper, strong, agile, courageous, nimble of thought, with the cold nerve to carry through instantaneous decision in spite of the distraction, danger and inevitable panic. For partner, man needed superman. He had to settle for superbeast.

Biolabs, trying to create a demigod in man's own image, inevitably turned first to the higher primates. For varieties of reasons monkeys, apes, chimpanzees, gorillas, et cetera, all failed to qualify, usually because their one-track minds derailed trains of thought after about one full minute of concentration. They were mercurial, inattentive, disinterested though curious, and even more inclined to panic than were men.

Next on the list, predictably, was man's ancient ally, the dog. Canines took eagerly to space travel, adapted readily to odd atomspheric compounds, showed little unhealthy response to differences in pressure, were not easily thrown into panic, and had the real advantage of loyal devotion to their masters. On the debit side, their slave-complex gave them a complete incapacity to initiate ideas, to think logically and understand even the most elementary arithmetic. They remained slaves and companions, pets rather than partners. They were stubbornly stupid as if the breed had been behind the door when brains were given out. Dogs were not the answer.

Housecats had their day—but failed, too, due to their closed-circuit minds, their limited reactions to directed mutation, especially to growth stimuli. Larger than the size of a well-fed Persian, the animals became lethargic and morose, usually dying of obscure glandular complaints. Cat-minds and cat-bodies both had definite limitations supplied by nature; they were difficult to teach, full of blind spots, and rigidly limited in size and potentials of mechanical ability.

A rat experiment promised more, but proved deadly dangerous. Rats were highly intelligent and startlingly

adaptable. Controlled mutation took care of anatomical limitations, gave them increased size, developed delicate, skillful hands. Rodent minds blotted up technical educations, learned quickly, remembered well, and quickly made use of all available knowledge. Unfortunately—from the human point of view—serious character flaws became rapidly apparent. The beasts were species-conscious, working together with maniac efficiency, vicious between groups with no quarter asked or given, treacherous in their jealousy and hatred for mankind, suicidally savage in implementing their traditional feuds with cats, dogs . . . and man.

That experiment had to be quickly discontinued. In self-defense, the experimenters in Biolabs slaughtered the races of mutant rats, and felt the odd guilt of genocide while carrying out the massacre. Even so, the brutes almost got out of hand, and there were casualties.

Backtracking, Biolabs tried their techniques on larger cats, all carnivores, and all notorious for trigger-tempers. The lions were most intelligent, but too lazy ever to be taught to work for a living. Also, they lived in family groups, hunted in concert, and resisted all attempts to separate them from their group way of life. Some other large cats were exclusively hunters, and remained so. Even in mutation, instincts and interests stayed set, and all processes designed to change them produced only neuroses.

Oddly enough, one of the least promising branches of the cat family showed most signs of success. Only after leopards and cheetahs and lions had been tried did anyone think of trying to tame and reconstruct tigers. Tam was not the first of his kind, but he was the most recent, and in some ways, the most startling. With eight generations of selected pedigree behind him, not to mention much scientific meddling with gene-patterns, he was a magnificent animal.

A few of the larger apes had got through, managing to get past the various stages of processing, retaining their mutant factors and remembering enough of their educations to be useful. A very few of them were actually in service as stand-by space pilots. Quite a number of the large cats of various species had made the grade. In the main they were successful experiments, and useful as human facsimiles, if not always as pilot-surrogates. However, Tam was unique of his kind. The first, but not, Biolabs hoped, the last. They held great hopes for him, and for the vast avenues of scientific achievement his success would open up.

"Our job," Brook explained, "is not just a dry run. We have to make a complete circuit of the rings of Saturn, as you know, following a patterned course. But that's only part of the job. We also have to pick up the robot cameras automatically trained upon the planet from various points in the rings, we have to replace film and reset the cameras, check the mechanisms, and then bring back the exposed film. I'd say we were night-

watchmen punching time clocks in various parts of a big warehouse, but I don't suppose you'd know anything about that."

"I know," said Tam. "And you can stop patronizing me. My education is quite thorough. Possibly better than yours in many ways."

"Monkey tricks, maybe. And some parroting of general background culture. Probably you've had training in simulated close-up maneuvering, but it's not the real thing. Matching motion and latching onto a non-spherical chunk of matter flipping over and over in its own crazy rotation pattern is one of the trickiest deals you'll ever encounter. Every decision and every reflex action stands a good chance of being your last."

Tam smiled with aggravating calm. "Long speech, bwana. Is it supposed to frighten me?"

"It should. Sitting on my hands while a green pilot does it always frightens me."

"Do I frighten you, bwana?" jeered Tam.

"Any raw test pilot does. And you seem rawer than most. This isn't your jungle, pussycat. This is space. It's big and tough and mean."

Tam stared unblinkingly, his eyes cold and luminous.

"Perhaps it is just a bigger jungle. Don't you think I am big and tough and mean?"

"It doesn't worry me, pussycat. You're a long way from your home jungle. This is my jungle. I know it. I like it. If you try throwing your weight around in my jungle, I'll pull your fangs for you and make you gum them down. Savvy."

Tam laughed. "Little man talks big. A few generations ago, my ancestors considered mankind too low-grade game even to hunt. We left man-eating to the old, the toothless, the crippled of our kind. There are other jungles, other hunts. And don't call me pussycat. Tomcat, at least. My name is Tam. I am surrogate pilot 97C. Tam is simpler, unless you prefer to call me 'sir.' "

"All right, chum. When the mother ship drops us off, we travel to the rings on robot pilot. We can check the magnetic tapes and feed them in. I'll let you know when to take over. And when I do, you're on your own. You'll have to trim orbit, set a course as it's marked on the charts, and do your own worrying. I don't take over unless you flub out. Understood?"

"Right, Bwana Brook. It should be an interesting test voyage." His luminous eyes became veiled and thoughtful.

Sleeping, Tam dreamed:

Race memories stirred and he roamed deep jungle. Hot lances of sungold streamed through the filtering lacy foliage overhead. It lay in pools on shadowy pathways among the tangled masses of cool greenery. His senses knew and recognized the smell of rotting vegetation, the soft caress of thick mud by the river, the slashing cut of sawgrass on his flanks, the sounds of rustling small life deep-hidden in the forest. In retrospect, he caught a sharp scent of fresh

blood, and the rank taste of raw flesh, salty, rich, satisfying. Blood-memories knew all these things and many more, their arrogant tiger-stalk as lords of their environment, a joy of hunting and slaying, the mystical darkness of an untouched wilderness, a contemptuous, but oddly disturbing, knowledge of mankind.

Other memories prowled the dark fastness of mind, the pride of being, the knowledge of instincts smothered or distorted by mutation, the reluctant yielding of body patterns, retention of the old sureness and grace, the warping of senses and desires, but still the hot, flaring identity of tiger-being. Form might be altered, paws become hands, new motivations take the place of old, but something remained. Something elemental.

"Tiger, tiger,

Burning bright . . ."

Sleeping, Tam moved restlessly.

Like a triggered spring, he awoke. He awoke, remembering.

To blunt the weariness of passing hours, he studied "The Space Pilot's Handbook."

Saturn; possible orbits from Titan . . .

Saturn, rings of . . .

Ring "A"—outermost ring, outer diameter one hundred sixty-nine thousand miles, inner diameter one hundred forty-nine thousand miles, divided by two minor gaps.

Separated by two thousand miles interval "Cassini's Gap" from

Ring "B" smaller and brighter about sixteen thousand five hundred miles breadth,

Contacts Ring "C" at inner diameter, so-called Crepe Ring, darkish and diffuse, inner diameter ninety-two thousand miles, although extremely diffuse matter extends eight thousand five hundred miles to surface of planet Saturn.

Composition of Rings diffuse matter, largely rock debris and solid—frozen—ammonia snow, believed wreckage of satellite destroyed by tidal action.

Tam slammed the book shut. Nothing there not already memorized. Nothing to occupy his mind, release pressure built up in his nervous system. He paced the restricted interior of the ship as restlessly as a cat in a cage.

The hours dragged past somehow. The mother ship dropped the survey cruiser.

"Relax," advised Brook, not unkindly. "You've wound yourself up too tightly."

"I feel all right," said Tam, shooting a quick glance at the dark emptiness beyond the viewplates. A large slice of the glowing globe of Saturn occupied one side of the visible.

"We'll have to close the cover flaps on the viewplates."

"Don't do me any favors," snapped Tam.

"I'm not. It's required. You're supposed to make this run on instruments. However, if it will make you feel any better, you can switch on the outside televiewers. They relay a picture inside. There's no regulation against that. In fact, you'll have to

use them when we try to sneak up on the camera placements. Remember, they're no different from any other asteroids. Just junkheaps of loose rock, mostly stuck together with frozen ammonia."

"I know that." Savagely.

"All right, friend. You'll be flying broken pieces of orbits. Don't get jerky or impatient, or you'll blast us in to Saturn, or halfway across space. The escape velocity of Saturn is a little over 22 mps, which is rough, so don't get careless. I won't bother you, unless you flub and I have to take over. So good luck. It's all yours."

Calm flowed into Tam as he felt the controls in his hands. He gripped them solidly, learning the feel, experimenting, getting to know the responses. Race memories rose from his deepest subconscious. A sense of power, of mastery, knowledge of his new environment, and sureness of his ability to deal with it.

He became, like any pilot, part of the ship. Its reflex was his reflex. He was the ship . . .

Sureness. Power. Happiness, such as he had never known, never dreamed existed . . .

Once around the rings of Saturn, dipping in and out of the agglomerations of cosmic debris, implementing split-seconds of decision with exact timing of action. Normally only a demented space pilot would subject himself or his ship to such continuous strains, such frequent changes of direction, such intricacies of maneuver. The test allowed only a minimum of departure from the scheduled pattern, only a minimum of initiative to the apprentice pilot. But no sanely planned spaceflight would skirt so closely the infinite possibilities of disaster.

Disaster came, of course. In space, emergency comes quickly, from any angle, and is by definition unpredictable. It was a small thing, but a diamond is small. The random factor in this case was a chunk of meteoric debris, basically identical to the rest of the local matter, but with one important difference. This one was not part of the ring. It was a rogue meteor caught in the gravity of Saturn, possibly pursuing a violently eccentric orbit of its own, possibly heading for Saturn on collision course.

It never reached Saturn. The space cruiser, with Tam at the controls, got in the way.

Emergency is sudden and definite. It can be complete and fatal. But a survey cruiser, new-model, is planned with high margin for error. End over end went the ship, like an insect hit on the wing, but not smashed. Tam eventually wrestled some sense into ship motion by firing auxiliary jets in sequence, but the main drive was off. While the flip-ups lasted, both Tam and Brook had a rough ride.

"That was fun," commented Brook. "Shall we do it again?"

"You're joking, of course."

"Only to hide how scared I am," admitted Brook uneasily.

"What happened? Or is this just

part of a rigged gimmick to see how I'll react in a real emergency?"

"No gimmick. I think we can assume that something hit us. It happens. The question is, how much damage is done? Can we fix it? And how much time do we have?"

"What do you want me to do?" inquired Tam.

"You figure out where we're heading on the new orbit. I will check the ship."

In a few moments, Tam glanced up from his figures.

"We're in trouble," he observed.

"I guessed that," agreed Brook. "How bad?"

"Present orbit will intersect the surface of Saturn. At our present speed, the ship will burn up in atmosphere long before we crash. In any case, the surface of Saturn is not a comfortable alternative. We will have to repair the ship. Have you located the damage."

"None inside," said Brook. "Use the outside viewers to scan. Maybe you can see something."

"Main jets are jammed apparently," said Tam a minute later. "They shut off automatically. Won't go on again. What happens now?"

Brook shrugged. "That depends on the damage. We can go outside and poke around, but we haven't drydock facilities. I can't make a prognosis until I see what's wrong."

"Outside," said Tam, closing his eyes briefly.

"Outside. Get your suit on, buster. Bring torches."

"Right, chief."

Outside, there was scenery. Almost too much of it. To one side, ahead, was the gleaming bulk of Saturn. The Rings were an immense veil of reflected radiance, diffuse but dazzling as brightly lighted snow. Stars shone through the Rings in patches. And beyond, everywhere, was the great star-sprinkled darkness of Space.

Space, seen through the viewplate of a helmet, is the most awe-inspiring sight known to man.

Brook tapped his apprentice on an armored shoulder and pointed. On magnetic soles, they made their way aft. Except for the ship and each other, all directions seemed curiously irrelevant to anything. There was no point of reference.

For a small object, the meteor had done an incredible amount of damage. Angling into the main drive jet, it had been instantly melted and volatized. But during those microseconds of heat and pressure increase, the lining of muzzle, jet and firing chamber had melted and flowed. The muzzle was blocked solid.

Brook and Tam worked for a while at the hopeless project, but got nowhere. Eventually, Brook signaled a return inside the ship. Silently they stripped off their suiting and stared at each other.

"Well," said Brook softly. "It was nice knowing you."

"I'm incapable of accepting death philosophically," Tam said. "Not as long as I have a fang, or claw, or brain. There has to be a way out."

"I can't think clearly," objected

Brook. "Can you think of anything?"

"That's your department. I'm not the pilot with space experience. You're supposed to know all the answers or figure out new ones at need."

"You're right," admitted Brook unhappily. "I'll try to think of something."

Brook put his mind to the problem. Thought moved in his brain as sluggishly as if wading through thick syrup.

"I have a faint recollection of something that was tried once . . . under similar circumstances. It probably won't work, but we haven't much to lose."

"We'll try it," said Tam.

"We can rewire the circuits and cut out the automatics. Then fire the main drive."

"But if the jet muzzle is blocked, the charge will just build up pressure and heat and explode right in the chamber."

"Yes, that's the chance we take. One of two things will happen. The ship will blow up, or the heat and pressure will melt out the obstruction. It will go with a *whoosh*, though, and may flatten us inside the ship like a pair of squashed bugs. If not, we'll be knocked way out in space. We can set the atom-powered distress transmitters operating, and there's a faint hope that the mother ship will find us before we run out of air or starve. What do you know about wiring?"

"Enough," said Tam. "I'll get at it while you work the ship into position."

"Good boy," commended Brook.

Tam's eyes glowed violently. "Let's leave the compliments until we're safely back on Titan. What happened to that other ship you mentioned?"

"It blew up," Brook told him.

Grinning, Tam set to work . . .

Standing over his apprentice, Brook watched Tam make the final connections.

"What does 'bwana' mean, Tam? It sounded like some kind of cuss-word. I didn't like the implication, but I hated to admit my ignorance. Is it African?"

"Yes, African, but I'm not, of course. It's Swahili, an old partly made-up language. Pidgin African. The word means 'Lord and Master.' I learned it from a Kenya leopard I knew in school."

"You've stopped calling me bwana."

"You've stopped acting like a lord and master of all creation."

Brook gestured at the main switch. "Shall we try it now, and see how it works?"

Tam raised a clawed finger and stroked his whiskers.

"It has to work . . ."

It worked.

Back on Titan, Brook faced the Examiner across a huge desk of polished glass.

"Tam passed?" asked the Examiner.

"Yes, Tam passed," said Brook. "One recommendation, though. One

bad flaw psychologically. It will have to be given corrective psychotherapy."

"Serious?"

"Not if it's fixed now. I learned something about myself out there, too. I have a bad flaw of my own. Back to the Butcher Shops for corrective psychotherapy for me, too. I'm turning myself in for treatment."

The Examiner scowled, then smiled ironically. He read Brook's recommendations and stamped the papers . . .

Outside, Tam was standing, waiting for Brook. Together they stared up at the great transparent dome above the city, and the larger vault of darkness and stars outside.

"You passed," said Brook, handing Tam his papers. "How does it feel to be a pilot surrogate? You're no longer a new fish. And that's a big bowl out there, room for a lot of fish."

Tam nodded absently, "I'm proud and happy." He went on slowly, "But a little sad, too. Possibly nostalgic, for jungles . . . and other things. It's a big bowl and lots of room. Maybe we'll never see each other again."

They walked together across the quadrangle toward a piled mass of dark buildings.

"Aren't you going out of your way?" asked Tam.

"No," said Brook sharply. "I need repairs myself."

"You? Psychotherapy?" Tam showed surprise.

"Each of us has his own neuroses."

Tam seemed embarrassed. "Yes, you caught mine. I hoped it didn't show."

"Nothing to be ashamed of. Just a minor tangle in your brain or nervous system. You didn't realize I noticed, but I saw that your eyes were closed all the time we were trying to work outside the ship. Agoraphobia —fear of open spaces. Lots of people have it, but it's no neurosis for a spaceman. Most people with that fear would have frozen into panic-helplessness. Not you. You closed your eyes and stayed with it. I'll give you credit for guts."

"From you—that's a real compliment."

"I have another for you. I've applied for a transfer to the regular survey ships. Two-man crews, you know, with the big job of taking a look at the universe and seeing what makes it tick. I'll need a partner, and with my seniority, I can pick my own. Would you like to join me?"

"Like it—I'd love it!" Tam cried excitedly. "But I thought you didn't—"

"I still don't." Brook studied Tam speculatively. "I knew I had it. I've always known. But I didn't think it would matter in space. But science caught up with me. Now, suddenly, it matters a great deal. Aleurophobia —fear of cats."

"You weren't just riding me?"

"No. I was riding you, but also ribbing myself."

"After you come out of psychotherapy, I'd like to shake your hand," said Tam.

They both laughed.

"If yours was as bad as mine, I pity you," observed Tam. "Fear isn't the word. It was stark, absolute horror. Something mystical, not just fear. I felt sick, frozen inside. I wanted to scream, just looking at all that emptiness, and the stars beyond. I couldn't look and I couldn't tear my eyes away. My brain felt stunned, and panic hammered in every instinct. Inside the ship, I felt fine, safe with the shell of metal around me. Looking out the viewplate was not too bad. But outside—"

"I know. One question, Tam. Personal. I wouldn't ask, but if we're to work together, I have to know."

"Ask ahead, partner."

"That's just it. I don't want to offend a partner. In space, the relationship is too close. Do humans really stink?"

Tam frowned. "Sure they do. But not so much I couldn't get used to it in a man I work with."

"I'll try chlorophyll," promised Brook.

"You'll have your problems," said Tam. "Trying to get used to having a tame tiger around won't be easy. Tigers are not ship pets, you know."

"Not even tame ones?" Brook kidded.

Tam's luminous eyes disappeared in depth.

"Not too tame . . ."

THE END

THE ANALYTICAL LABORATORY

With two months to report on, we're pressed for space . . . so here's the report on the two issues:

FEBRUARY, 1958

PLACE	STORY	AUTHOR	POINTS
1.	Brute Farce	Eric Frank Russell	2.31
2.	The Man Who Counts (Pt. 1)	Poul Anderson	2.68
3.	Aristotle And The Gun	L. Sprague de Camp	2.90
4.	No Way Out	Robert Silverberg	3.95
5.	Achilles' Heel	Christopher Anvil	4.22

(*Continued on page* 72)

....NO

BY RANDALL GARRETT

As cultural techniques change, the obvious of one may become the insoluble mystery to later archaeologists—

"IMITATION," said Ducem Palver, "is supposed to be the sincerest form of flattery, isn't it?"

Dr. Nikol Buth inspected what was left of his cigar and decided that between the ash and the chewed stub there was not enough tobacco to make further puffing worth while. He dropped it into the disposal and watched the bright flash of light that marked its passing before he answered the question that Palver had asked.

"In a way, I suppose—if you can call it imitation to take a hint from a myth and develop something from it."

Ducem Palver leaned back in his

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CONNECTIONS

chair. His blue eyes seemed to twinkle beneath his slightly arched brows, although there was no obvious trace of a smile on his round face. "Then," he said, "you consider mathematical treatment of vast numbers of human beings to be a myth?"

Dr. Buth considered that for a moment. He hardly knew how to speak to his visitor. Palver, he knew, occupied some small post in the Imperium — Imperial Librarian, Third Class—but Buth wasn't sure just how important the man was nor exactly why he had come. Nor did he know how much Palver knew of archaeology.

Buth said: "I realize that people once believed in such a thing—seven or eight hundred years ago. But the barbaric period of the Interregnum, before the establishment of the Second Galactic Empire, was hardly a period of vast scientific knowledge." He gestured with one hand. "Oh, I'll grant you that there may just possibly be something to the old story that a mathematical treatment of the actions of vast masses of human beings was worked out by a scientist of the First Empire and then lost during the Interregnum—but I don't believe it."

"Oh?" Palver's face was bland. "Why not?"

"It's ridiculous on the face of it. Discoveries are never lost, really. We still have all the technological knowledge that the First Empire had, and much more; myths and legends, on the other hand, have no basis, except in easily explained exaggerations."

Palver looked the slightest bit defensive. "Why do you call them legends? It seems to me to be a bit too pat to say that those arts which

were not lost were real and that those which *were* lost are legendary."

Dr. Nikol Buth had long since made up his mind that Ducem Palver was nothing but another small-time, officious bureaucrat who had decided, for some reason, to make a thirty thousand light-year trip from the Imperial capital just to get in his, Buth's, hair. Inwardly, he sighed. He had walked on eggs before.

Outwardly, he was all smiles. "I'll admit it sounds odd when you put it that way. But look at it from another angle. We have fairly accurate information on the history of the First Empire; the last ten thousand years of its existence are very accurately documented, thanks to the information found in the old Imperial Library. And we have no mention of 'lost arts' or anything else like that. None of the records is in the least mysterious. We know that one nonhuman race was found, for instance. Nothing mysterious there; we know what happened to them, how they escaped the First Imperial Government, and their eventual fate."

Dr. Buth fished in his pocket for another cigar and found none. He got up and walked over to the humidor on his desk, saying: "On the other hand, the records of the Interregnum are scanty, inaccurate, and, in some cases, patently falsified. And it is during the Interregnum that we find legends of supermen, of mental giants who can control the minds of others, and of 'lost' sciences which can do wonders."

Buth lit his cigar, and Ducem Palver nodded his head slowly.

"I see," the librarian said at last, "then you don't believe that a mathematical treatment of the future actions of a mass of people could be formulated?"

"I didn't say that," Dr. Buth said, somewhat testily. "I said that I did not believe it was ever done in the past." Then he forced a smile back onto his face and into his voice. "Not having any such thing as a mathematical system of prediction, I can hardly predict what may be done in the future along those lines."

Ducem Palver steepled his hands pontifically. "I'm inclined to agree with you, Dr. Buth—however, I understood that you had evolved such a system."

Dr. Buth exhaled a cloud of smoke slowly. "Tell me, Mr. Palver, why is the Imeprial Government interested in this?"

Palver chuckled deprecatingly. "I *am* sorry, Dr. Buth. I didn't intend to lead you to believe that the Imperium was interested. In so far as I know, they are not." He paused, and his blue eyes seemed to sparkle for a moment with an inner, barely hidden mirth. "Ah, I see that you're disappointed. I don't blame you; it would be quite a feather in your cap to have your work recognized by the Imperium, would it not? I'm truly sorry if I misled you."

Buth shook his head. "Think nothing of it. As a matter of fact, I should be . . . uh . . . rather embar-

rassed if my work came to Imperial notice at this time. But . . ."

". . . But, then, why am I here?" Palver finished for him. "Purely out of personal curiosity, my dear sir, nothing more. Naturally, the records of your published works are on file in the Imperial Library; my position at the Library is that of Keeper of the Files. Have you ever seen the Files?"

Dr. Buth shrugged. "No—but I've read descriptions."

"I'm sure you have. It's a vast operation to feed all the information of the galaxy into that one great machine to be correlated, cross-indexed, filtered, digested, and abstracted so that it may be available at any time. Only about one billionth of the total information flowing into that machine ever comes to my direct notice, and even then it is fleetingly glanced over and forgotten.

"But my hobby, you see, is History." He pronounced the word with a respect touching on reverence. "I'm especially interested in the—as you pointed out—incomplete history of the Interregnum. Therefore, when your mathematical theories of archaeology came to my attention, I was interested. It happens that my vacation period came due some weeks ago, so I decided to come here, to Sol III, to . . . ah . . . have a chat, as it were."

Dr. Buth dropped some cigar ash into the dispenser and watched it flare into oblivion. "Well, I'm afraid you may find you've come for nothing, Mr. Palver. We're not investigating Interregnum history, you see."

Ducem Palver's blue eyes widened slightly and a faint look of puzzlement came over his cherubic face. "But I understood that you were working on pre-Imperial civilization."

Dr. Nikol Buth smiled tolerantly. "That's right, Mr. Palver. Pre-*First*-Imperial. We're digging back more than thirty thousand years; we're looking for the origin of the human race."

Palver's face regained its pleasant impassivity. "I see. Hm-m-m."

"Do you know anything of the Origin Question, Mr. Palver?" Buth asked.

"Some," admitted Palver. "I believe there are two schools of thought, aren't there?"

Buth nodded. "The Merger Theory, and the Radiation Theory. According to the Merger Theory, mankind is the natural product of evolution on all worlds with a water-oxygen chemistry and the proper temperatures and gravitational intensities. But according to the Radiation Theory, mankind evolved on only one planet in the galaxy and spread out from that planet after the invention of the first crude hyperspace drive. I might point out that the Merger Theory has been all but abandoned by modern scholars."

"And yourself?" Palver asked.

"I agree. The Merger Theory is too improbable; it requires too many impossible coincidences. The Radiation Theory is the only probable—one might almost say the only possi-

ble—explanation for the existence of Man in the galaxy."

Palver leaned over and picked up the carrying case which he had placed beside his chair. "I transdeveloped a copy of your 'Transformations of Symbolic Psychology and Their Application to Human Migration.' It was, in fact, this particular work which decided me to come here to Sol III. I'm not much of a mathematician, myself, you understand, but this reminded me so much of the old legends that . . . well, I was interested."

Dr. Buth chuckled. "There have been, I recall, legends of invisibility, too—you know, devices which would render a human being invisible to the human eye so that he could go where he pleased, undetected. If you had heard that I had written a paper on the transparency of glass, would you be interested?"

"I see the connection, of course," said Ducem Palver. "Just how does it apply here?"

"The legend," Buth said, puffing vigorously on his cigar, "concerns a mathematical system which can predict the actions of vast masses of people—the entire population of the galaxy.

"My work has nothing to do with prediction whatever — unless you want to call it prediction in reverse. I evolved the system in order to work backwards, into the past; to discover, not what the human race was *going to do,* but what it *had done.* You see, there is one fatal flaw in any mathematical prediction system; if people know what they are supposed to do, they will invariably try to do something else, and that can't be taken into account in the system. It becomes a positive feedback which automatically destroys the system, you see."

Palver nodded wordlessly, waiting for Dr. Buth to continue.

"But that flaw doesn't apply to my work because there can't be any such feedback into the past. What I have done is trace the human race backwards in time—back more than thirty millennia, through the vast migrations, the movements through the galaxy from one star to another, taking every lead and tracing them all back to their single focal point."

"And have you found that focal point?" Palver asked.

"I have. It is here—Sol III. My system shows positively that this is—*must be*—the birthplace of the human race."

Ducem Palver looked out the transparent wall at one end of the room. "I understand that archaeologists have always supposed the Origin Planet to be somewhere here in the Sirius Sector, but I wouldn't have thought such a bleak planet as this would be the one. Still"—he laughed pleasantly — "perhaps that's why they left."

Dr. Buth allowed his gaze to follow that of his visitor to the windswept, snow-covered terrain outside. "It wasn't always like this," he said. "For reasons we haven't nailed down exactly as yet, this planet shows a

definitely cyclic climate. There appear to be long ice ages, followed by short periods of warmth. Perhaps, in the long run, the cycle itself is cyclic; we're not too sure on that score. At any rate, we're quite sure that it was fairly warm here, thirty to fifty thousand years ago."

"And before that?" Palver asked.

Buth frowned. "Before that, another ice age, we think. We've just barely started, of course. There is a great deal of work yet to be done."

"No doubt. Ah—what have you uncovered, so far?"

Dr. Buth stood up from his chair. "Would you like to see? I'll show you the lab, if you'd like."

"Thank you," said Ducem Palver, rising. "I'd like very much to see it."

A well-equipped, operating archaeological laboratory is like no other laboratory in the galaxy. This one was, if the term can be used, more than typical. Huge radiodating machines lined one wall, and chemical analyzers filled another. Between them were other instruments of all sizes and shapes and purposes.

The place was busy; machines hummed with power, and some technicians labored over bits of material while others watched recorders attached to the machines in use.

Dr. Buth led his visitor through the room, explaining the function of each instrument briefly. At the end of the room, he opened a door marked: SPECIMEN CHAMBER and led Ducem Palver inside. He waved a hand. "Here are our specimens—the artifacts we've dug up."

The room looked, literally, like a junk bin, except that each bit of junk was carefully tagged and wrapped in a transparent film.

"All these things are artifacts of Man's pre-space days?" Palver asked.

Buth laughed shortly. "Hardly, Mr. Palver. This planet was a part of the First Empire, you know. These things date back only ten or eleven thousand years. They prove nothing. They are all from the upper layers of the planet's strata. They've been duly recorded and identified and will doubtlessly be forgotten.

"No, these are not important; it is only below the D-stratum that we'll find anything of interest."

"The D-stratum?"

"We call it that. D for Destruction. There is an almost continuous layer over the land of this planet, as far as we've tested it. It was caused, we believe, by atomic bombardment."

"Atomic bombardment? *All over the planet?*" Ducem Palver looked shocked.

"That's right. It looks as though uncontrolled atomic reactions were set off all over the planet at once. Why? We don't know. But we do know that the layer is nearly twenty-five thousand years old, and that it does *not* antedate space travel."

"How so?"

"Obviously," Buth said dryly, "if such a thing had happened *before* mankind discovered the hyperspace drive, there would be no human race today. Man would have died right

here and would never have been heard of again."

"Of course, of course. And what have you found below that . . . uh . . . D-stratum?"

A frown came over the archaeologist's dark eyes. "Hardly anything, as yet. Come over here."

Ducem Palver followed his host across the room to a pair of squat objects that reposed on the floor. They looked like pieces of grayish, pitted rock, crudely dome-shaped, sitting on their flat sides. From the top of the irregular dome projected a chimney of the same material. They were, Palver estimated, about thirty-six centimeters high, and not quite that big in diameter at their base.

"We haven't worked on these two yet," Dr. Buth said, "but they'll probably turn out the same as the one we've already sectioned."

"What are they?" Palver asked.

Buth shook his head slowly. "We don't know. We have no idea what their function might have been. They're hollow, you notice—you can see the clay in that chimney, which was deposited there during the millennia it lay in the ground.

"See this flange around the bottom? That's hollow, too. It's a channel that leads to the interior; it's connected with this hole back here." He pointed to another hole, about the same size as that in the top of the chimney, but located down near the base. It was perhaps seven centimeters in diameter.

"And you haven't any definite idea what they were used for?" Palver said.

Buth spread his hands in a gesture of temporary bafflement. "Not yet. Ober Sutt, one of my assistants, thinks it may have been some sort of combustion chamber. He thinks that gases—hydrogen and oxygen, for instance—might have been fed into it, and the heat utilized for something. Or perhaps they were used to synthesize some product at high temperatures—a rather crude method, but it might have been effective for making . . . oh, ammonia, maybe. I'm not a chemist, and Sutt knows more about that end of it than I do."

"Why does he think it's a high-temperature reaction chamber? I mean, why *high*-temperature, specifically?"

Dr. Buth waved his cigar at the objects. "They're made out of a very crude ceramic, a heavy mass of fired silicon and aluminum oxides, plus a few other things. They're eroded, of course, and rather fragile now, but to stand up under all the abuse of three or four hundred centuries, they must have been pretty strong when they were made."

"Perhaps the ceramic was used because of its structural strength?" Palver said, half questioningly.

"That's doubtful. We know they used metals; there are oxides of iron, copper, zinc, chromium, and aluminum everywhere, in deposits that indicate the metals once formed artifacts of some kind. It wouldn't

be logical to use a ceramic, brittle as it is, when metals were used."

"So you think the combustion chamber idea is the most likely?"

Dr. Buth took a long pull at his cigar and looked abstractedly at the glowing ash. "Well, Ober Sutt puts up a good argument for it, but I don't know . . ." He waved again with the cigar. "Those things don't have any bottom, either, and I don't think they ever did—not connected directly, at least. Sutt counters that by saying that they must have sat on a ceramic plate of some kind, but so far we haven't found any of those plates, if they exist."

Palver looked carefully at the two objects, then shrugged. "What else have you found?"

"Aside from a few shards," Dr. Buth said carefully, "that's all we've found below the D-layer. However, as I said, we've just begun."

Back in Buth's office, Ducem Palver picked up his carrying case, snapped it shut. "Well, I'm sorry to have bothered you, Dr. Buth," he said. "I must admit, however, that the solution of the Origin Question holds little interest for me. The history of the latter part of the First Empire, and that of the Great Interregnum—ah, those are deeply interesting. But, as to how Man came to be spread throughout the galaxy—" He lifted his eyebrows and cocked his head to one side. His blue eyes seemed very deep for a moment. "Well, Man is here. I will leave it to others to find out how he got here, eh?"

Dr. Buth smiled tolerantly. "It's just as well that we're not all interested in the same thing, isn't it?" He walked over to the transparent wall and looked out at the bleak whiteness of the windswept snowscape. "But to me, the fascinating thing about Man is his peculiar drives. Imagine a time when men had no spaceships, no modern instruments of any kind. What must it have been like to look out at the stars and feel trapped on one single planet?"

Behind him, Ducem Palver's voice said: "Perhaps you could draw a parallel from the planet Kaldee. During the Interregnum, they were cut off from the rest of the galaxy; they lost all their history—everything. They knew nothing of the spaceship, nor of the stars themselves. They thought those lights in the sky were nothing more than bits of glass, reflecting the light of their sun. They believed the night sky was a black bowl a few miles above their heads, upon which these pieces of broken glass were fixed."

"Oh?" said Dr. Buth without turning. "And how did they feel about their isolation?"

"They didn't know they were isolated. They were quite happy, all things considered. They had no burning desire to leave their planet—indeed, they reserved that privilege for the dead."

Dr. Buth's brows drew together. "Then what made primitive Man want to leave? Why wasn't he happy

on one planet? What happened?"

And suddenly, it seemed as if his whole mind came to a focus on that one question. *Why had they decided to conquer space? Why? What caused that odd drive in Man?*

"I've got to know," he said—aloud, but very softly.

Ducem Palver didn't even seem to hear.

After nearly a full minute, Ducem Palver said quietly, "I must be going now. I wish you success, Dr. Buth."

"Yes," said Buth, still looking at the icy plain outside. "Yes. Thank you very much, Mr. Palver. Very much. Good-by."

Ducem Palver left him that way, standing, staring at the whiteness of the landscape of Sol III.

It was an old planet, civilization-wise. Not, thought Dr. Nikol Buth, as old a planet in that respect as Sol III, but old, nonetheless. Before the Interregnum, it had served as the capital of the First Empire, and before that, as the nucleus from which the First Empire had grown. It had once been a mighty world, sheathed in metal and armed with the might of the Galactic Fleet, the center of strength of the First Galactic Empire. And then that Empire had fallen, collapsed in upon itself, and with it had collapsed its capital.

It had been great once. And now?

Now it was beautiful. The capital of the Second Empire was far away in space, and this old planet was of no consequence whatever. But it was beautiful.

It was a garden planet now, filled with green forests and broad sweeps of grass and fields of flowers. It was a place where a young man could relax for a few weeks before returning to the busy work of maintaining the Empire, a place where an old man, freed from the seemingly eternal grind, could find peace in doing other, less strenuous work.

Dr. Nikol Buth was such a man. He was old now, and the years had not treated him kindly; now, after thirty years of driving himself towards an unattainable goal, he sought only peace. Here, on this garden world, he would find it.

It wasn't easy to become a permanet resident here. The planet was an Imperial Protectorate, the personal property of the Emperor himself, although His Imperial Majesty never visited it. Tourists were allowed access to certain parts of it, but there were vast estates reserved for those who had earned the right to spend their last years in quiet and solitude. The right to live here had to be earned, and it had to be granted by the Emperor in person. In his pocket, Dr. Nikol Buth carried a precious document—a signed, sealed Imperial Grant.

He had landed at the terminal—like all spaceport terminals, a busy place, even here—and had supervised the shipping of his personal effects to his new home at a little village called Mallow and then had taken an aircar there himself.

At the air depot at Mallow, he had been met by a pleasant young man

who had introduced himself as Wilm Faloban—"General factotum and chief of police—for all the need they have of police here."

He had quietly checked Buth's identification papers and his Imperial Grant, then he'd said casually: "You haven't seen your home yet, I take it?"

Buth shook his head. "Not directly. Full stereos, of course; it's quite what I want. I—" He stopped, realizing that he wasn't making much sense to the young man. He started again: "I really don't see how I managed to get a place here; think how many must apply each year—hundreds of billions, I suppose."

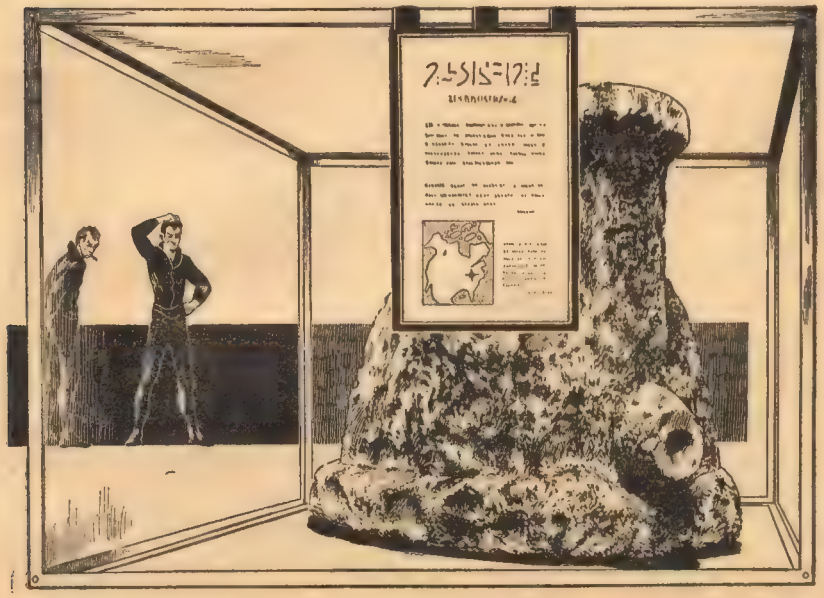
"About that," agreed Faloban. He opened the door of his ground car. "Hop in," he said, "I'll drive you out to your place."

Buth nodded his thanks and stepped carefully inside the little machine. He had to move carefully these days, had to remember that old bones are brittle and old muscles tear easily. "And how many are accepted?" he continued. "Only a few."

Faloban slid into the driver's seat. "An average of ten thousand a year," he said. "Not many are chosen."

"I don't know what I ever did to deserve it," Buth said.

Faloban chuckled as he trod on the accelerator and the little vehicle slid smoothly out to the road. "You really great men are all like that. You never think you've done anything."



"No, no," said Dr. Buth, "it's not like that at all. I really never did do anything."

Faloban just chuckled again. "You'll have to talk to your neighbor old Ducem Palver, on that score. He's always saying he never did anything, either. Amazing, isn't it, how the Emperor never picks anyone but ne'er-do-wells?"

But Dr. Nikol Buth wasn't listening. *Ducem Palver,* he was thinking, *Ducem Palver. Where have I heard that name before?*

And then he remembered. Aloud, he said: "Yes, I will have to see Mr. Palver. He's a near neighbor, you say?"

"Just a kilometer away. We'll go right by his place on the way to your new home," Faloban said.

It was a woman who opened the door, a short, round, pleasant-faced woman whose halo of white hair seemed almost silvery. She was old, yes, but her face still held the beauty of her youth, modified by the decades of life so that it was changed into a graciousness—almost a regal queenliness.

"Yes?" Her voice was soft, and her smile kindly.

"I—" Buth felt the hesitation in his voice and tried to overcome it. "I'm looking for Mr. Ducem Palver. My name is Buth—Dr. Nikol Buth. I . . . I don't know if he remembers me, but—"

The woman stood aside. "Come in, Dr. Buth, come in. I'm Mrs. Palver; I'll see if my husband is busy."

She led him to a chair and made sure he was comfortable before she left to find her husband.

Queer, thought Buth, *I'd never thought of Palver's having a wife. Still, it's been thirty years; maybe he married after—*

"Ah! Dr. Buth! How good to see you again!"

Buth covered his slight start at hearing Palver's voice by rising quickly to greet his host. A slight twinge in his back warned him against moving quite so rapidly.

Palver himself had changed, of course. His hair, which had been thick and black, was now thin and gray. His face was still full and round, although it tended to sag a bit, and his eyes seemed to have faded somewhat. Buth had the feeling that they weren't quite the deep blue they had been three decades before.

But he showed that he still had the same brisk way about him as he extended his hand and said: "Am I the first to welcome you to Mallow and Forest Glade?"

Buth took his hand. "Except for a young chap named Faloban, yes. Thank you."

"You liked cigars, I think?" Palver went to a panel in the wall, slid it aside, and took out a small cigar humidor. "I don't use them myself," he said, "but I like to keep them for friends."

Buth accepted the cigar, lit it carefully. "I have to limit myself on these," he told Palver. "I'm afraid I overdid it for too many years. My lungs aren't what they used to be."

"Well, well"—Palver pulled up a chair and sat down—"how have you been? I didn't think you'd even remember me—a nobody. What did you ever find on Sol III? I haven't been following your work, I'm afraid. They kicked me upstairs to rot a while back, you know; haven't been able to keep up with anything, really."

"There wasn't much to keep up with," Buth said. "Sol III was a dead end. I couldn't prove a thing."

Palver looked blank. "I don't think I quite understand."

Dr. Buth settled himself more comfortably in his chair. "There's nothing to understand. I'm a failure, that's all. No joke, no false modesty—no, nor bitterness, either. I spent thirty years of my life looking for something that wasn't there to be found, trying to solve a problem that couldn't be solved."

Ducem Palver looked somewhat uncomfortable. Buth noticed it, and realized that it was perfectly possible that Palver didn't have even the foggiest notion of what he was talking about. Thirty years is a long time to remember a conversation that only lasted an hour. Even Buth himself hadn't remembered it until Faloban had mentioned Ducem Palver's name.

"If you recall," Buth said swiftly, "my group and I were digging on Sol III, searching beneath the D-layer for anything that might show us that Sol III was the original home of mankind. Above the Destruction Stratum, everything was post-spaceflight; it proved nothing. But we did have hopes for the artifacts below that layer."

"I see," said Palver. "It turned out that they, also, were post-spaceflight?"

There was a trace of bitterness in Buth's short laugh. "Oh, no. We didn't prove anything—not *anything*. We don't know, even now, whether those artifacts we found were pre- or post-spaceflight. We don't even know who made them or how or why."

"What about those ceramic things?" Palver asked. "Were those all you found?"

Buth laughed again, bitterly, almost angrily. "It depends on how you mean that question, 'Were those all you found?' If you mean, did we find any more, the answer is an emphatic *yes*. If you mean, did we find anything else, the answer is almost *no*. We found plenty of them—to be exact, in thirty years we uncovered twelve thousand four hundred and ninety-five of them!"

He paused for breath while Palver blinked silently.

"After the first few thousand, we quit bothering with them. They got in the way. We had classified some two hundred different varieties under about nine group headings. We were beginning to treat them as animals or something, classifying them according to individual and group characteristics." His voice became suddenly angry. "For thirty years, I worked, trying to find some clue to the mind of pre-spaceflgiht Man. It was my one drive, the one thing on

my mind. I dedicated my life to it.

"And what did I find? Nothing but ceramic mysteries!"

He sat silently for a moment, his lips tight, his eyes focused on the hands in his lap.

Palver said smoothly: "You found nothing else at all?"

Buth looked up, and a wry smile came over his face. "Oh, yes, there were a few other things, of course, but they didn't make much sense, either. The trouble was, you see, that nothing but stones and ceramics survived. Metals corroded, plastics rotted. We did find a few bits of polyethylene tetrafluoride, but they had been pressed out of shape.

"We couldn't even date the stuff. It was at least twenty thousand years old, and possibly as much as a hundred and fifty thousand. But we had no standards—nothing to go by.

"We found bones, of course. They had thirty-two teeth in the skulls instead of twenty-eight, but that proved nothing. We found rubble that might have been buildings, but after all those thousands of years, we couldn't be sure. In one place, we found several tons of gold bricks; it was probably a warehouse of some kind. We deduced from that evidence that they must have had ordinary transmutation, because gold is pretty rare, and it has so few uses that it isn't worth mining.

"Obviously, then, they must have had atomic power, which implies spaceflight. But, again, we couldn't be sure.

"But, in the long run, the thing that really puzzled us was those ceramic domes. There were so *many* of them! What could they have been used for? Why were so many needed?" Buth rubbed the back of his neck with a broad palm and laughed a little to himself. "We never knew. Maybe we never will."

"But see here," said Palver, genuinely interested, "I thought you told me that one of your men—I forget his name—had decided they were used for high-temperature synthesis."

"Possibly," agreed Dr. Buth. "But synthesis of what? Besides, there were samples which weren't badly damaged, and they didn't show any signs of prolonged exposure to high temperatures. They'd been fused over with a mixture of silicates, but the inside and the outside were the same."

"What else would you have to uncover to find out what they were?" Palver asked.

Buth puffed at his cigar a moment, considering his anwer.

"The connections," he said at last.

"Eh?"

"They were obviously a part of some kind of apparatus," Buth explained. "There were orifices in them that led from some sort of metallic connection—we don't know what, because the metal had long ago dissolved into its compounds, gone beyond even the most careful electrolytic reconstruction. And there are holes in flanges at the top and bottom which—" He stopped for a moment and reached into his pocket.

"Here . . . I've got a stereo of our prize specimen; I'll show you what I mean."

The small cube of transparency that he took from his pocket held a miniature reproduction of one of the enigmatic objects. He handed it to Ducem Palver. "Now that's the—No, turn it over; you've got it upside down."

"How do you know?" Palver asked, looking at the cube.

"What?"

"I said, how do you know it's upside down?" Palver repeated. "How can you tell?"

"Oh. Well, we can't, of course, but it stands to reason that the biggest part would be at the bottom. It would be unstable if you tried to set it on the small end, with the big opening up. Although"—he shrugged—"again, we can't be sure."

Palver looked the little duplicate over, turning it this way and that in his hands. It remained as puzzling as ever. "Maybe it's a decoration or something," he said at last.

"Could be. Ober Sutt, my assistant for twenty years, thought they might have been used for heating homes. That would account for their prevalence. But they don't show any signs of heat corrosion, and why should they have used such crude methods if they had atomic power?" Again he laughed his short, sharp laugh. "So, after thirty years, we wound up where we started. With nothing."

"It's too bad you didn't find traces of their writing," said Palver, handing the stereo crystal back to his visitor.

"We did, for all the good it did us. As a matter of fact, we found engraving on little tiles that we found near some of the domes. Several of the domes, you see, were surrounded by little square ceramic plates about so big." He held up his hands to indicate a square about eight centimeters on a side. "We thought they might have been used to line the chamber that the domes were in, to protect the rest of the building from the heat—at least, we thought that at first, but there weren't any signs of heat erosion on them, either.

"They must have been cemented together somehow, because we found engravings of several sets that matched. Here, I'll show you."

He took out his scriber and notebook and carefully drew lines on it. Then he handed it to Ducem Palver.

"Those lines were shallow scorings. We don't know whether that is printing—writing of some kind—or simply channels for some other purpose. But we're inclined to think that it's writing because of the way it's set down and because we did find other stones with the same sort of thing on them."

"These are the engravings you found near the mysterious domes?" Palver asked.

"That's right."

"They make no sense whatever."

"They don't. They probably never will, unless we can find some way of connecting them with our own

language and our own methods of writing."

Palver was silent for several minutes, as was Dr. Buth, who sat staring at the glowing end of his cigar. Finally, Buth dropped the cigar into a nearby disposer, where it disappeared with a bright flash of molecular disintegration.

"Thirty years," said Buth. "And nothing to show for it. Oh, I enjoyed it—don't think I'm feeling sorry for myself. But it's funny how a man *can* enjoy himself doing profitless work. There was a time when *I* thought I might work on my mathematical theories—you remember?—and look how unprofitable that might have been."

"I suppose you're right," Palver said uncomfortably. He handed the notebook back to Dr. Buth.

"But still," Buth said, taking the notebook, "a man hates to think of wasting thirty years. And that's what it was."

He looked at the lines he had drawn. Meaningless lines that made a meaningless pattern:

EMPLOYEES MUST WASH
HANDS BEFORE LEAVING

"Waste," he said softly, "all waste."

THE END

THE ANALYTICAL LABORATORY

(*Continued from page* 57)

MARCH, 1958

PLACE	STORY	AUTHOR	POINTS
1.	Second Game	Charles de Vet and Katherine MacLean	1.72
2.	Penal Servitude	Randall Garrett	3.13
3.	The Man On The Bottom	Dean McLaughlin	3.17
4.	The Man Who Counts (Pt. 2)	Poul Anderson	3.34
5.	Try And Change The Past	Fritz Leiber	3.62

In both issues, as the point-scores show, there was a tight race for position; the narrow point-spread between second and fifth place in the March voting is decidedly unusual!

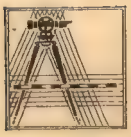
THE EDITOR.

THE... ...LAW SCHOOL

Illustrated by van Dongen

Law, generally speaking, results from codification of experiences . . . and there's nothing like experience to make a man interested in studying law. . . .

BY THEODORE L. THOMAS



AS SOON as the rocket landed the police threw a cordon around it and five of the biggest and strongest of them went in through the open port. As it turned out, five were not enough. Those waiting outside soon began to hear the most terrible noises. Yells, grunts and thuds were clearly discernible to those in the vicinity. It might be that the ship actually rocked slightly on its fins but that seems a little incredible.

Before long it became apparent that the five cops inside were not doing so well, so the sergeant sent in three more.

The ruckus inside the ship picked up in tempo for a minute or two and then suddenly died down. Another minute, and four policemen appeared at the port supporting a tall, stocky man with his arms handcuffed behind him. His black hair was ruffled and his nose was bleeding and his clothing was torn. But with it all he looked better than the eight policemen who hauled him over to the wagon, climbed in with him, and drove off to the station.

They wasted no time when they got there. They charged him with assault with intent to kill, aggravated assault and battery (nine counts), mayhem (nine counts), resisting arrest, malicious mischief, disturbing the peace, affray, riot, escape, obscene and profane language, and blasphemy. In short, they threw the library at him.

The trial of The United States v. Hogan started right off and it immediately became apparent that Frank Hogan was not unduly impressed with judicial processes. He objected to the five officers of the law who stood tightly around his seat with their hands on the butt of their revolvers and there was some slight altercation when the officers tried to make him stand up when the judge came in.

Judge Witmer was an experienced lawyer with a strong feeling for the innate dignity of man. He carried his sixty-six years as though he enjoyed them. He had been on the bench for fifteen years and had built a reputation for being much more interested in justice than in law.

Judge Witmer sat down and cast a practiced eye over Hogan's brawny figure and the tense circle of men around him.

"All right, Officers," said the judge. "Please take seats on the other side of the bar."

One of them started to protest, but the judge waved him quiet. When they were seated the judge glanced at the list of charges in front of him. Then he looked up at Hogan and asked: "Do you have counsel, Mr. Hogan?"

"No," said Hogan in a surprisingly small voice for so big a man. "And what's more, I don't want any. I don't trust these shysters."

The judge sighed and said: "Mr. Hogan. I am going to appoint counsel for you. Whether you like it or not you are going to be represented by counsel at this trial. The penalties you face are too heavy to be so lightly treated. We will take a half-hour recess while we find a lawyer for you." He banged the gavel and walked out of the courtroom.

Back in his chambers Judge Witmer got out the list and looked it over. He ticked off a name. And that is how Ellis Centerton got started.

Ellis Centerton was a new lawyer. High in his class at Georgetown

University Law School, he had spent a year with the firm of O'Hoolihan & Stuart. But Centerton was a man that liked to reach his own opinions. He went along with the rules of precedent as long as he was in law school because it was necessary to get a degree and be admitted to the bar. But once out he insisted on going his own way. He was one of those rare lawyers that was constantly ready to fight for the way the law should be rather than the way it was. This was admirable, except that the firm of O'Hoolihan & Stuart had to foot the bills. With the firm's lucrative practice in some jeopardy, it was mutually, amicably, and firmly agreed that Centerton should get the hell out and stay out.

And so he sat in his own office waiting for clients, the varnish hardly dry on his own shingle. Judge Witmer called him to ask him to take the Hogan case and in five minutes he was at the courthouse.

Centerton and Hogan held a brief caucus in the back of the courtroom, and then the trial started again. When Judge Witmer re-entered the room he glanced over at Hogan and saw how respectfully he was standing alongside Centerton. And the judge grinned slightly.

Centerton stood slightly taller even than Hogan and the heavy shock of sandy hair made him look still taller. But where Hogan was thick-set and heavy-built Centerton was lean and flat. Hogan moved with ponderous deliberation while Centerton moved with a quick lazy grace, carrying himself on the balls of his feet as behooved a collegiate boxer and an amateur mountain climber. But what made the judge grin was not so much the bigness of the two men as the expression on each of their faces. There was identity between the two. Each had the lower jaw thrust out, the eyes narrowed, the lips thinned, truculence in every line of the face. The judge gathered his black skirts around him and prepared to sit on what promised to be the liveliest case in many a day.

Centerton waived a trial by jury and did not even make the usual remarks about how he knew the judge was wiser than any jury and would see to it that a better caliber of justice would be meted out than a jury could dispense anyway.

The prosecutor ran eight freshly bandaged policemen through the witness chair. One after another they told of the horrendous things that had happened inside the spaceship when they went aboard to get Hogan. When they were done the prosecutor put on a couple of spaceship personnel who told of a short fight between Hogan and an astronomer on the flight down from the Station.

Then last, the astronomer himself testified. It was hard to hear what he said in view of the bandages round his face; and a broken jaw doesn't help one's speech under the best of conditions. The astronomer told how he had been having a quiet discussion with Hogan aboard the

ship and how Hogan had all of a sudden up and belted him one. "Hogan seemed a little bitter about his work on the Moon and I told him that what he needed was a cause to believe in. Then he hit me. That's all I said. 'You need a cause to believe in.' That's all I remember."

The astronomer stepped down and the prosecution rested.

Centerton got up and announced that the only witness for the defense would be Hogan himself. Hogan took the oath and sat down. Centerton crossed over to him and said, "State your name, age, and occupation."

"Frank Hogan. Thirty-three. Mining engineer."

"Do you have a job now?"

"Well, I think so."

"Would you explain that please?"

"Well, I was working at Number Four mine—Keating's mine, on the far side of the Moon. I'm supposed to go back there but I'm not sure I want to. After this I may not be able to anyway."

"Mr. Hogan, perhaps you had better go back to the beginning and tell us everything that led up to the fight on the spaceship."

"O.K." And Hogan shifted to a more comfortable position in the chair. Centerton turned his back on him and walked over to his seat and sat down.

"Well," said Hogan, "there's forty-one of us up there. We all rotate on the different jobs to keep everybody on his toes in all the work. We run a lot more than just a straight mining operation. It costs so much to get the hafnium back to Earth that we have to refine it right on the spot, and that's quite an operation. So anyway, it was my turn to take the dust off the inside of the dome. But I'd had trouble with one of the condensers and had been on my feet for twenty-one hours so I asked . . ."

"I object," said the prosecutor. "This testimony is all irrelevant. It has nothing to do with the charges this defendant is being tried under."

Centerton was on his feet. "Patience," he said quietly. "Patience. This will all become germane to the issues in due time. It does relate to the trial."

The judge said: "I will overrule the objection. But this testimony will be disregarded if it is not later shown to be relevant. Proceed, Mr. Hogan."

"Well," continued Hogan. "I was so tired that I couldn't hold my head up. I asked Joe Rogers if he would do my job of dust-scraping for me. We switch off like that every once in a while. All forty-one of us did it. Now there's nothing wrong with that, is there Judge?" And he turned around to look up at Judge Witmer.

"I haven't the faintest idea what you're talking about yet," said the judge. "Please continue."

Hogan grunted and faced front.

"Well, anyway," he said. "Joe Rogers said he would remove the dust for me. I went over to a corner to have a smoke so I saw everything that happened. I saw Joe climb up

and go to work. He's up on the scaffolding scraping away for about two minutes when he lets a shovelful of dust get away from him and it happens to drop right on the head of Hank Aden who happens to walk underneath the scaffold at that moment."

Hogan stopped to shake his head, and then he continued. "Hank is a good-natured guy as a rule but I guess he wasn't feeling so good that morning. He looked up at Joe and I could see he was mad. Even then it probably would have been all right. He called up at Joe and asked him what was the idea. Joe looked down and for the first time he saw that he had hit Hank with this shovelful of dust. Hank was a sight. And then Joe did it. He laughed. Everything would probably have been all right, but Joe laughed."

Hogan leaned forward and said: "You should have seen Hank. He went up that ladder like I never saw anyone move before, even in low gee. He got to the platform at the top and he didn't even slow down. He sailed right into Joe and the two of them started a real slugging match up there at the top of the scaffolding. Quiet, too; they fought real quiet. Now let's see."

Hogan thought for a moment, then said: "Yes. Bud Boyer saw them. He was switching the seats of a dozer around. He knew that if there was one thing Jud Westgate—he's the chief engineer—wouldn't stand for it was a fight. He reared back with the seat he was holding and heaved it up at Joe and Hank. It missed and sailed clean across the dome and caught Frank Harrison right between the shoulder blades, knocked him flat. Frank rolled over and looked around and saw Joe and Hank fighting. Now normally nobody says anything when a couple of the boys have a little brawl. But Frank must have been a little dazed from being hit with the seat; he must have thought there was a riot or something. He hollered out at the top of his voice 'Fight.' "

Hogan shook his head again. "That was a bad thing to do. It just gets everybody excited and it makes sure that Jud Westgate learns about the fight and that makes him awful mad and then somebody is in trouble. But this time it was worse than ever. Frank yells 'fight.' Harry Robinson was working across the dome and up to that time he didn't know that anything was going on; it had been pretty quiet up to them. Several of us had thought that Harry was getting hard of hearing, and now I know it. When Frank yelled 'fight,' Harry thought he yelled 'fire.' So what does Harry Robinson do but start running around screaming 'fire' at the top of his lungs. Somebody pushed an alarm button. And, brother, that started it."

Judge Witmer and the prosecutor were looking at Hogan in open-mouthed amazement. Centerton sat there with a half-smile on his face. There was a short period of silence and then Centerton said, "Please go on, Mr. Hogan."

Hogan nodded and said: "Well, it all happened so fast I couldn't do anything to stop it. Those engineers are a bunch of tough boys, but if there is one thing that will scare them to death it's a fire. You can see why. Things are rough enough at the mine, but a fire could easily kill us all. All our equipment has been carefully planned so that we have what we need and no more. If some of it were destroyed, we couldn't live. We were out of touch with Earth, too, so we were completely on our own. If a fire burned a hole through the dome, we were dead, like that." And Hogan snapped his fingers. Then he went on.

"The boys came boiling up out of the shaft, out of the shops and labs and refinery, and some of them came staggering out of the sleeping quarters. That fire siren will wake the dead. We have fire drills once a week and everybody knew what to do. The trouble was that everybody seemed to be across the dome from where he was supposed to be. So they were racing around grabbing up the fire-fighting equipment and knocking each other down.

"Toward the end when they were getting organized and beginning to look around for the fire the Hofferth brothers came running up out of the deep shaft where they had been working and jumped on the dozer they were supposed to man during fire drill. They got the motor going full tilt before they got seated and the dozer lurched right out from under them. The thing plowed through the boys who were lined up ready to march off and fight the fire. It's a good thing the blade of the dozer was down otherwise somebody might have been killed. As it was most of the boys got pretty badly messed up. Doc Wertz had to let the refinery furnace go for a day while he splinted up arms and legs and treated pulled muscles and tendons and sewed up some nasty cuts.

"Well anyway, things finally quieted down enough for me to explain that there was no fire and that it was all a mistake. This all happened inside of about thirty seconds so I couldn't do anything about it before. I can tell you, everybody was pretty mad. Out of the forty-one guys there, only me and Andy Harness came out of it with a whole skin; Andy'd been standing by the back entrance to the dome during the fire drill. So those guys were plenty mad at me and Andy even though we had nothing to do with it."

Hogan leaned back and took a deep breath before he continued. "Jud Westgate was fit to be tied. Our schedule was shot and it would be a while before things got back to normal. After everybody got patched up we did the best we could to keep production going, but our efficiency wasn't what it might be. And then Jud opens an investigation to try and find out who was responsible for the whole mess. That was something. It almost wrecked the complete mining operation. We'd sit around discussing who did what

and two of the boys would get pretty hot. But they didn't dare do anything in front of Jud Westgate so they'd meet later in a lonely spot and try to beat each other's brains out. There must have been thirty fights during the first two days of the investigation, all of them quiet so Jud wouldn't learn about them. They're a rough bunch of boys, but not one of them wanted Jud down on him.

"You see, for over a week Jud had been waiting for somebody to pull a boner. We had been having trouble with our food concentrates. The concentrates were plenty nourishing all right but after a while you just couldn't eat them. The boys were losing weight and getting stomach cramps so Doc Wertz says we have to send a man back to Earth to work with the food people and get some decent concentrates or food up here. But that meant traveling around to the Earthside face of the Moon to board the rocket that puts in every three months. We only get one every nine months. And that's a rough trip. You have to do it in a small caterpillar and you need to carry so much fuel you can't take enough food and water. That trip can kill a man so nobody wanted to make it. And Jud said that whoever was responsible for that mess about the fire was going to be the man to go back to Earth. So you can see why the boys were arguing about who was to blame."

Hogan leaned forward again. "We argued for two days and we couldn't figure out who to pin it on. It didn't seem right that Joe Rogers should get the blame for dropping that shovelful of dust because all of us dropped dust on that job. We thought we had it pinned on Hank Aden for starting the fight with Joe but he pointed out that he thought Joe had done it deliberately; after all, Joe had laughed at him. Hank said he thought he was going to get it again so he went up to protect himself, so we let Hank off the hook. And that's the way it went right down the line. Everybody had just made some tiny mistake, the sort of thing all of us up there did all the time. We didn't know who to blame. Then Harry Robinson found something that solved it for us. Oh, he solved it fine.

"He was reading a microfilmed history book on his off-shift and he found a sentence that was supposed to be used by lawyers to figure out who was to blame when a whole lot of things happened. It sounded like just the thing we were looking for. The only trouble was it was written in Latin. But I'll never forget what it said. *Causa causantis causa est causati.* That's what it said. *Causa causantis causa est causati.* It stumped us until we found that Andy Harness knew Latin. He translated it for us. He said it meant: The cause of the thing causing is the cause of the effect. Is that right, Judge? Is that really what it means?"

The judge looked over at Centertor and the prosecutor and said, "Yes, that's exactly what it means.

That doctrine was stated in an old case . . . let me think—" He leaned back in his chair for a moment and closed his eyes, then he opened them and leaned forward: "Yes. It was a Massachusetts case, an old one. Marble v. The City of Worcester, that's it. Of course the *causa causantis* doctrine isn't used anymore."

"No," agreed the prosecutor. "I think the Palsgraf Case would be controlling here."

Centerton nodded agreement and said, "Yes, the test of forseeability would control."

The significance of the remarks of the lawyers sank in on Hogan. "Wait a minute," he said. "You mean this *causa causantis* thing isn't right? You mean that ain't the way the law is? Why those dirty dogs! They picked ME. They said that I was the guy that started it all off by asking Joe Rogers to do my work for me. If I hadn't done that, it never would have happened, they said. If I had been up there doing my own work, this whole shambles would never have got started, they said. So under this *causa causantis* thing I was to blame, they said. So YOU are the one to go back to Earth, they said. Why, those dirty dogs! Judge," Hogan rose half out of the witness chair, "tell me, who was responsible for that mess up there? Who should have come to Earth instead of me? Tell me who it was and when I get back there I'll . . . I'll—"

Hogan's high-pitched voice broke. He recovered himself and continued: "I like to died on that trip around the Moon. They had to pull me out of that caterpillar; I was only half conscious. All because of that *causi causantis* thing. I got on the rocket still so weak I could hardly stand, I'm mad as hell about this *causi causantis* business anyway. Then I talk to this guy"—he pointed at the astronomer who had been a witness against him—"and he tells me I need a 'cause' to believe in. So I smashed him in the jaw. That's all there is to it. Now you come along and tell me that I shouldn't even have been blamed for everything that happened at the mine. If I'd known that, I might have killed that guy. He doesn't look any too strong to me." He pointed at the astronomer again and then sat quietly.

Centerton looked over at the prosecutor and said, "Any cross-examination?"

The prosecutor shook his head. "No. I think the picture is complete."

Centerton heaved himself up on his feet and said, "Your Honor. I think we can all see what happened here. This defendant was in an extremely unstable state of mind. The unfortunate remark of one of the complaining witnesses triggered the whole chain of events that led to the charges he is faced with here. We recognize that his state of mind does not excuse his conduct, but we do think that his state of mind should mitigate against the normal punishment in a case like this. Let us now do justice to this man as it was not done for him up on the

Moon. He has paid a price that was not his to pay. It is not his fault that they do not have lawyers on the Moon, even though they seem to have needed one badly up there. We should not penalize this man for society's fault in not supplying legal knowledge where it is needed. I ask that the Court sentence this man to six months in jail, and then suspend the sentence. I also ask that the prosecutor join me in this recommendation." And Centerton looked over at the prosecutor.

The prosecutor got slowly to his feet, rubbing his chin reflectively. "Well," he said, "in view of the peculiar nature of this situation, I'm inclined to go along with counsel for the defendant. It is incredible to me that this defendant should have been blamed for that fiasco at the mine; the majority opinion in the Palsgraf Case is so clear. If the—"

"Who should have been blamed?" said Hogan from the witness chair. He stood up in front of the chair. "Tell me who it should have been. Come on now. Who was it?"

Judge Witmer banged his gavel and said, "Sit down, Mr. Hogan. It doesn't matter who was to blame. The point is moot; it's all over. Sit down and be quiet."

Hogan sat. The judge leaned back and looked at the ceiling. For a long moment there was absolute silence in the courtroom. Then the judge leaned forward and said, "Mr. Centerton, I'm inclined to go along with you, too. But there's one thing that disturbs me. How are we going to correct the basic situation? Those men on the Moon are fine men, fully qualified to do a difficult job. But they are completely ignorant of the law. Their numbers are growing. Soon the same type of man will be on the other planets. I wonder where this is going to lead us as far as the law is concerned. Must we put up with good men who harm other good men because they don't know or don't care about the law? I certainly hope not."

Again there was silence in the courtroom.

The judge spoke again, this time looking fixedly at Centerton. "Tell me, Mr. Centerton, can you think of any way to help me overcome my doubts about the future if I let this defendant go?"

Centerton stared back at the judge; his eyes widened. Centerton spun on one toe and paced back and forth a couple of times. Then he turned and faced the judge and said: "All right, Judge. I will go up and spend some time with those men if you will follow my recommendation as to this defendant."

Bang went the judge's gavel. "So ordered," he said.

And Hogan walked out a free man.

Well, Centerton went up to Keating's Mine with Hogan when he returned. Nobody has ever said what happened after he got there; they just won't talk about it. We can learn from the day-to-day records at

the mine that Doc Wertz had to improvise on splints when he ran out of them. We also know that the Doc had to order up a special supply of sutures. But the records don't show much else. And we know that when Keating's Mine finally petered out two years later all those mining engineers and Centerton came back to Earth together.

Well, that was fifteen years ago. Judge Witmer was right. We've now got men on five planets and eighteen satellites. Men have really started to expand through the solar system. New legal problems arise every day, but nobody worries much about them. Whenever a legal problem comes up they just turn it over to Centerton's law firm and it solves it. Most of the time the problem never even gets into the law courts.

That's quite a law firm. Ellis Centerton is probably the best man in the firm but his partners are no slouches either. They're all big men who like a lot of action, but they're all highly skilled lawyers, too, all forty-one of them.

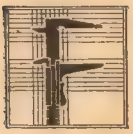
THE END

IN TIMES TO COME

Next month's issue features "The Miracle-Workers," by Jack Vance. It's a decidedly unusual angle on the possibilities of the future . . . with a mirror-image viewpoint on the subjects of Magic, "mysticism," and Science that you will, I think, get as much fun out of as I did—and Kelly Freas did. Freas, by the way, had some fun with the illustrations on this one; those of you who've been attending science-fiction conventions recently, may recognize some of the characters Kelly pictured in his spot illustrations—he used some handy models here at the office. Ed Emshwiller—"Emsh" of our covers—makes a fine Chief Magician, it seems!

THE EDITOR.

TRANSLATION BY MACHINE



FOR some while, various groups in the computer laboratories have been trying to work out techniques for getting a logical device—a computer—to handle the hyper-logical problem of translation of language.

This month's cover represents one kind of offshoot of that class of problem. Ed Emsh's "Pastoral" represents a statement in the language of color and form; to reproduce it mechanically some two hundred thousand times requires that the original be translated from human-artist language into some form of machine-language that a printing press can handle. The problem, my friends, is somewhat more of a Grade A ornery double-crossing dilly than may at first appear.

Ed Emsh . . . or Kelly Freas, or Van Dongen . . . is free to use, and normally does use, a whole palette-full of colors. Some mineral pigments, some remarkably brilliant organic dyes, titanium dioxide white, carbon black—quite a range of materials. Thousand of 'em available, and no telling which ones any particular artist will pick to use.

The printing presses, however, are limited to a maximum of four pigmented materials; white paper represents the base line from which the pigments will depart.

Now it's been said that Aristotelian logic is a black-white system, with no intermediate grays. That's not quite true; a series of steps makes possible any desired intermediate point betwen one hundred per cent pure white and one hundred per cent pure black. A binary computer, for instance, has available an Aristotelian 1 or 0—but by using positional notation it can produce any desired de-

gree of shading between 0.00000000 . . . and 1.00000 . . . Aristotelian black-white, yes-no, 1-0 type logic works just fine on any pure gray problem. Purely mechanical reproduction of black-and-white photographic material, for instance, can be achieved with almost any desired degree of precision, by purely mechanical means. The standard black-and-white half-tone reproductions can break down the problem to any useful degree of fineness of discrimination; on the paper in this magazine, about eighty decisions per inch is the best we can use, because that's the finest discrimination of which this type of paper is capable. (Since our main business is fiction, wherein photographic reproduction is meaningless, it is economically unsound to use a type of paper which can reproduce photographs. The cover stock on this magazine can reproduce over two hundred fifty decisions per inch.

At normal viewing distance, the normal human eye can distinguish about one hundred thirty black-white decisions per inch; therefore a half-tone print using one hundred fifty black-white decisions per inch—a "150-line screen"—will fully satisfy the demands of the eye.

In a photograph made with silver grains in a gelatin emulsion, it's easy to achieve one thousand black-white decisions per inch; the eye can't distinguish more than one hundred thirty or so, and is fully satisfied with such a photograph.

But this is pure black-white decisions. Pure Aristotelian logic. Let's consider, now, two gray tones, each of which reflects exactly 50.0000% of the incident visual illumination. One is a blue-gray, and the other a red-gray, however. The ordinary black-and-white reproduction must, since it has only pure-black-silver (or carbon-black ink) and white paper, reproduce the two exactly the same.

For color reproduction, however, we depart from the straight-line-from-black-to-white of Aristotelian logic, and go into a multi-dimensional problem; two identical grays —in that both reflect exactly the same percentage of incident energy— are totally dissimilar. The shadow cast by a sphere, a cylinder, and a disk on a surface may be identical, although the forms are widely dissimilar.

Color reproduction is a multi-dimensional problem . . . and gets even trickier, by reason of the business of the difference between transmitted color and reflected color. Mix red pigment and green pigment, and you get something ranging from a muddy brown to solid black. Add red light to green light, though . . . and you get white light.

Now when you take a photograph of a painting, you illuminate it with light—presumably white—and the camera works on the light reflected from the painting. But that is by no means as simple as it sounds; your product in the camera will be a transparency—whether you get an Ektachrome transparency, or a Kodacolor type color-negative.

And *that* works by *transmitted* light.

In order to get back to a presentation to be viewed by reflected light, the language of transmitted-light-reproduction must be retranslated to the very different language of reflected-light-reproduction.

To date, all forms of color reproduction are one part extremely complex photochemical science, one part extremely complicated machinery, and one part human genius.

As usual, there aren't enough human geniuses to go round. What *can* be done with ordinary amateur snapshot color pictures, when worked into color prints by an artist-with-color-photography is not what *is* done.

What *can* be done in reproducing an artist's painting in four-color printing is not what is ordinarily achieved; there aren't enough geniuses at that particular art to go round, and even for a genius at the art, it takes time, patience, and trying.

The *Time-Life-Fortune* group of magazines has established a research center for development of printing and publishing techniques; such research is expensive, and it takes a major investment to accomplish much. Only for a major publishing group can such investment pay off. Fine color reproduction is extremely valuable to a magazine like *Life*—and is just about a hopeless problem, since the human genius required can't work on a news-magazine schedule. Naturally, *Time-Life* would like to save money—but saving time is, for a news outfit, even more critical.

The problem was to reduce the amount of human genius required, by increasing the science in the formula. If the human judgment could be extended by the use of electronic devices, a sort of human-judgment-amplifier, the speed with which the process could be carried out would be increased.

The machine that has been developed seems to go a long way toward the goal; it's still short of perfection . . . but what isn't? This month's cover was reproduced for us by the *Time-Life-Fortune* group's research and development center, the Printing Development Incorporated subsidiary of Time, Inc. which has been set up to market the results of that research program.

The steps are as follows: First, an Ektachrome transparency of Emsh's cover was produced, by standardized photographic process. Human judgment steps in here; a man judges whether the Ektachrome is satisfactory. If he isn't satisfied—and don't ask him precisely how he determines whether it is "satisfactory" or not!—another transparency, exposed in a slightly different way, is made. (The color-temperature of the lighting used may be changed; longer or shorter exposure may be used, et cetera.) But one way or another, a "satisfactory" Ektachrome transparency is produced.

The transparency is then strapped on a rotating, transparent drum, and

scanned by fine light-beams. Inside, the light is diverted to three photoelectric cells, through three color filters. The three outputs are fed to an electronic computer, which delivers *four* output signals to *four* variable light-sources, which impinge on standard black-and-white negative film, scanning these in perfect synchronization with the scanning of the original Ektachrome.

The result will be four black-and-white negatives, which yield a red-printer, yellow-printer, blue-printer, and black-printer for the four-color presses.

Now this is a simple, and obvious idea, isn't it? Should have done it years ago, no?

No.

It's anything but simple—it's just obvious.

It's a translation problem. A certain amount of the particular red dye used in Ektachromes, plus a certain amount of the particular yellow dye used in Ektachromes, produces a certain exact color of *transmitted* red-orange light.

What quantity of a totally different red pigment, having an entirely different spectral distribution of light-reflection, plus what quantity of a completely different yellow pigment, laid down on white paper, will produce the same color of *reflected* light?

Now the intensity-range possible in transmission-color is almost unlimited. A deep red can stop 99.99% of blue light—yet if the illuminating source is intense enough, even the 0.01% of blue light that does get through has effect on human visual senses.

In transmitted-light color systems, intensity ranges of one thousand to one are usable.

If you've ever tried to take pictures of trees after a sleet storm, you'll have encountered the problem, even if you didn't recognize it. The sleet, sparkling in a brilliant sun, is shining like a billion diamonds scattered over the forest when you look at it —and the picture is pure black and white. Black tree trunks, and brilliant white sparkling of sleet.

But the print you get back is a disappointment. No sparkle. Reason: any tone on the print that reflects less than about 2% of the incident light, records as "black" in the eye. Then if the sleet-spots reflect 98% of the incident light, and the tree trunks less-than 2%—the maximum light range is only forty-nine to one. Dull and uninteresting, isn't it?

So the computer that gets the information from the photoelectric cells has to make corrections for the impossibility of getting the full range of transmitted-light variation.

And that's a place where human judgment has to be imposed. But here the electronic device can act as a judgment-amplifier; once human judgment has been expressed in terms of definite, specific instructions, set into the machine as settings of potentiometers, the electronic circuit can *apply* that judgment-decision

one hundred thousand times a second . . . which no human mind could do.

The problem of expressing one kind of "red" in terms of quantities of "red" having different spectral characteristics, is more complex than that statement indicates. Actually, it's a sort of topological transformation; all three color-quantities interact at all times. To express the Ektachrome's pure-"red," the printing press pigments may have to be mixed in proportions of 85%-red, 11%-yellow and 4%-blue. And if the Ektachrome yellow requires 95%-yellow, 2%-red, and 3%-blue on the press . . . then what printing-press colors will express something that the Ektachrome represented by 42%-red and 58%-yellow?

Simple and obvious, isn't it . . . ?

Also, different publishers use different commercial color printing inks. You can't get away with setting up just *one* system of translations; you've got to work out a system-of-systems, and arrange things so the computer can be instructed to make any commanded system of translations.

Then there's an additional point. The Ektachrome does the whole business with three colors, three dyes. But printing processes that use only three colors don't produce satisfactory color reproduction; it takes three color pigments, plus black. So the three photocells feed three color signals into the computer, and the computer feeds *four* signals to the light-sources that produce the printer-negatives.

Question: Where does the fourth signal, the black-printer signal come from? There was no "black" signal in the Ektachrome.

The three photocells measure the intensity of light of their three colors reaching them. In an area that is pure, 100% red, the outputs would be 0%-blue, 0%-yellow, 100%-red. A white area would, of course, be 100%-blue, 100%-yellow, 100%-red. Pure black, then, would be 0%-blue, 0%-yellow, and 0%red.

Here's where Aristotle gets into a jam, though. A blue-gray tone must, on the printers, represent a little blue pigment, plus quite a bit of black pigment. On the Ektachrome, black is produced by absorbing all the red, all the yellow, and all the blue light of the light-source. But on the printing press, black is produced by *one* process—printing carbon-black ink.

The Ektachrome would produce a blue-black sky, for instance, by absorbing 80% of the blue, 95% of the yellow, and 100% of the red light from the source. The printing press would do it with 100% blue pigment laid over a 90% black.

How do you instruct a computer to make that cross-correlation translation?

The meaning of a 5% red signal *may* be "The area is a very deep and intense red." On the other hand, it may mean "The area is to be printed as solid black." It will depend on

how much signal is coming from the two other photocells at that particular instant.

The computer has to do a remarkable piece of translation—and it has to be adjusted by human beings with excellent judgment and color-sense. Learning how to adjust it is a most difficult problem in self-education, because changing any *one* control, due to the interaction of all three signals, changes *all* the color-effects . . . and you can't see the effect immediately, but only many hours later, when the color-printer negatives have been processed, and printed up as color-prints!

The great advantage of the device, however, is that it has a constancy-of-reaction that allows a man to see, eventually, the effect of what he did —and to repeat that effect reliably. And once a man has developed the color-judgment required—the machine amplifies his ability to *apply* that skill enormously. The speed with which a color transparency can be turned into a set of printing plates is enormously increased.

The development of such machines, and the growing skill of the men who supply the judgment the machines amplify, will mean better color reproduction not only much more quickly—critical to the news magazines that started the research—but also in greater quantity.

There remains, however, something that no printing process yet imagined can do. In transparency color, you can catch the flaming, luminous color of a sunset; you can have a color-intensity range of five hundred to one.

But not on printed, reflected-color reproductions. "Cheap calendar art" gets the phony effects it does by trying to do with reflected color, something that simply can't be done.

Then, too, there's the problem of "color temperature." If you have used Kodachrome or Ektachrome at all, you know that color film "balanced" for daylight produces most peculiar effects if used with incandescent lights . . . and "indoor" or incandescent-light color-film distorts colors in daylight. (The color-negative materials like Kodacolor overcome the problem by using correction filters at the printing stage.)

Question: If you have an astronomical telescope, and want to take color pictures of the stars, to show how they look in color . . . what kind of color-film do you use?

The Printing Development Inc. color-translation machine offers real hope for superior color process in the future. Your comments on the cover are wanted.

THE END

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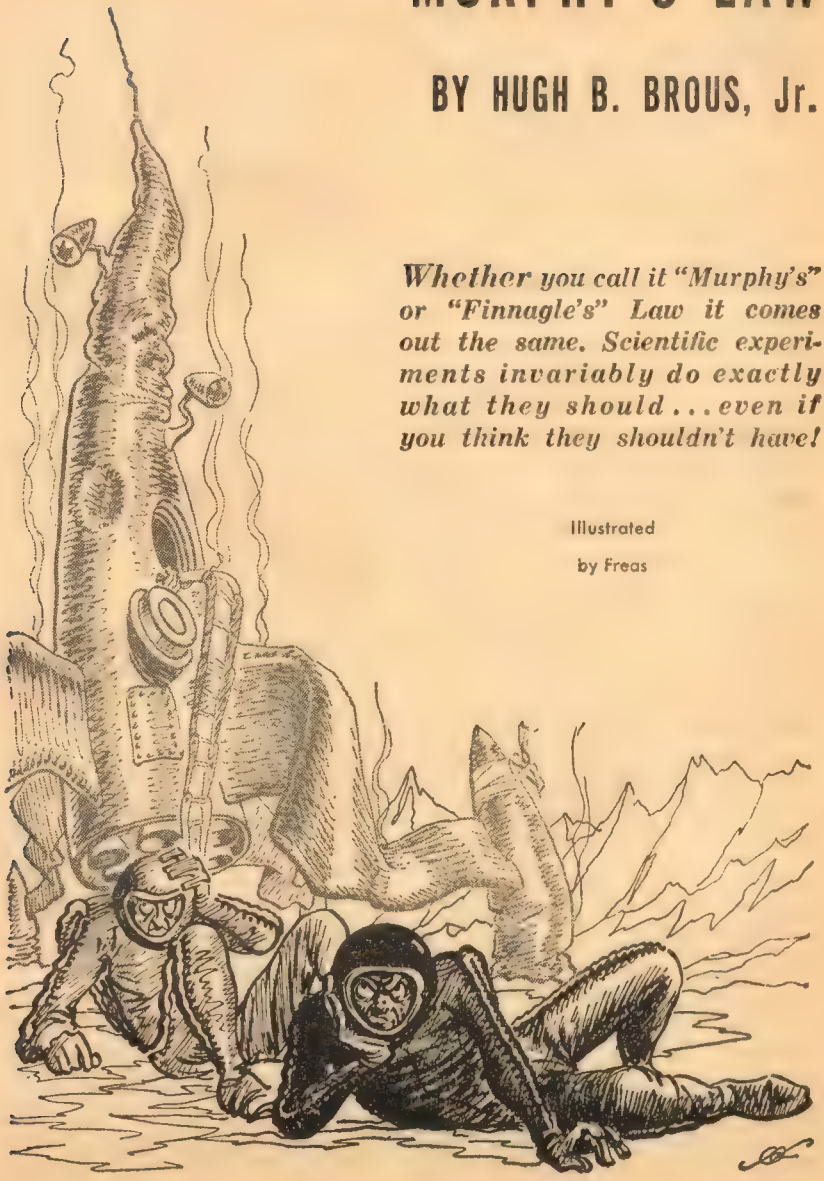
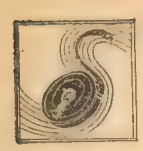
MURPHY'S LAW

BY HUGH B. BROUS, Jr.

Whether you call it "Murphy's" or "Finnagle's" Law it comes out the same. Scientific experiments invariably do exactly what they should . . . even if you think they shouldn't have!

Illustrated by Freas





URE! I was aboard the *Flying Bucket*. We made the first flight out into outer space. But I'm on the deck from now on and forever. Space flight is for the asteroids, not me. That whole trip is now considered a classical example of Murphy's law. You know, the one that says that if anything can go wrong, it will. On that trip to the Moon it did—regularly.

First off, the contractor that built the second stage made it out of balance with the first and third, and the lopsided thing toppled over on the first test firing. The second test, without people aboard, of course, fizzled and plopped into a megabuck bonfire. The next two tests weren't much better, although number four did get up to a nice altitude before it blew. We should have known from all of this that the trip would be fraught with frolic.

Even while the firing crowd was trying to get something up into the air we crew members were having our hilarities. There were only two of us, Carl Blutz and myself. We had a jolly time with the control panel in the first mock-up simulator that we crawled into. Some of the meters wound up clockwise and some counterclockwise, and some didn't go at all. The design engineers got all pushed out of shape, but they made the necessary changes to put all those clocks on the same time.

Our next ruckus with them was over the window. They said we could not have one, and we said we needed it, and in the end we lost. Cosmic radiations, meteoric dust, and all sorts of space trash would make glass ports dangerous, they said. So they gave us a bunch of TV scanners instead. If you wanted to see what was about to ram up your tail pipe, switch to Channel 6.

On the first dry run in the *Flying Bucket* itself Murphy's Law was enforced to the letter. Somebody left a quaint goof in the control panel wiring such that when power was turned on all the needles pegged on the high side. That burnt out about a dozen pots and ten times that many connections. That ultimately resulted in launching postponement number one.

Number two was caused by local storm warnings that lasted a week. I got a nice sun tan during that week. At the end of the week Blutz set up postponement number three. The medicos shipped him off to the hospital for possible surgery, but it turned out to be a case of an overdose of groceries. Nobody seems to know the why of number four. The best reason seemed to be that everything was working properly, which was certainly not normal for the *Flying Bucket* project.

And then on the day before the actual flight the cowboy from the motor pool, who was hauling our space gear out to the launch site, dumped his wagon over into the ditch, and my helmet was cracked. We tried a quick patch, but in a decompression test it blew into ex-

pensive bits. It looked like postponement number five coming up until somebody dug up the prototype helmet. It was examined and put through a mess of tests in a hurry and declared perfect—except for one detail. It didn't fit. So I went out into space with a hat costing a chairman of the board's salary stuffed with an old newspaper to make it fit.

The launch site was pure panic with a capital P the morning we finally did go up. Somebody started the rumble that the firing was off again, and even though this notion was squashed with great celerity most of the people showed up late. The cook never did show. We had a miserable breakfast cooked, and I use the term loosely, by a member of the base finance office. Fortunately almost everything had been readied during the previous night and a lot of people were still around. So with a crowd of tired and/or tardy people the show was ready by firing time.

Firing time! That was not a point in time but half a day. Some clumsy genius tripped over a cable in the control blockhouse and disconnected half a dozen lines. Those all had to be plugged back in and checked out. The control officer arrived with a cold in the head and was impossible to understand over the radio. We squawked him, and his voice was replaced.

After sweating half a day we got the word and buckled down into our take-off and landing-pads. The voice replacement started the count down and became so overcome with the magnitude of his responsibility to the project that he lost the count between seventeen and twelve. We didn't know for sure when the rockets were supposed to fire. That was a cheerful few seconds after the zero count while we waited for the blast that didn't come. We figured the *Bucket* had misfired, and that we would probably go out into space as hot vapors.

But the rockets suddenly caught fire, and we started up. Somewhere in the neighborhood of a 2 G acceleration one of the supports on my take-off pad snapped, and my weight times a fat fudge factor rested on my left elbow. It still hurts when I think about it. I didn't have any luck getting it fixed in the short time between dumping the first stage and firing the second.

That second-stage firing was a hell of a lot rougher than anybody had said it would be. Both of us blacked out. When we woke up the *Flying Bucket* was gliding out to an orbit with the second-stage gear gone. Blutz and I worked fast to make our visual checks before the third-stage photons sent us on our happy way. Good old Murphy's Law again—half the control panel showed meters pegged on the high side. We reported this to ground control and waited for an answer. No answer. No receiver! It was knocked out with me and Blutz.

A quick check of the navigation gear showed that it was still func-

tioning, and that we were within the proper round-off error of a good course. The computers and guidance gadgets ticked away waiting for the right point in space and time to start the photons streaming. Just as the photons started up our lookout radar picked up a piece of junk coming our way from the rear. We switched to Channel 6 on the TV scanners.

It was a real piece of junk. The TV showed us a close-up shot of an old IGY satellite going like crazy almost on our course. It pulled up on the outside of our orbit just as we were starting out. Naturally we collided. Blutz and I took another long count.

When we arose from our involuntary siesta we surveyed the damages. There was no serious hull damage, but we suffered severe internal injuries. The transmitter was out, and the emergency set was shattered, so we couldn't tell the folks back home of our many thrills and adventures. And to make it even more joyous our TV scanners were out which left us flying almost blind. The guidance radar still showed a big fat pip for the Moon on one side of the screen. For better or worse we were on our way in a battered and slightly defective Model 1 spacecraft.

Even with photon rockets building you up to a nice cruise speed it still takes a while to dash out to the Moon and back. Blutz and I licked our wounds and went to work trying to put some of the knocked out gear back in order. Blutz did get our radio receiver working, but for only one lousy station. He could get a farm station in North Dakota whenever the Earth was turned right. The TV scanners and transmitter were hopeless scrap. We threw a diagnostic on the guidance radar and computers, and they checked out to the good. A computed course showed that we were on our way toward the pip on the radar. We also calculated that this was the Moon. We refused to worry about landing and leaving the Moon until it had to happen. We were plenty busy just finding and fixing bugs in our traveling hardware.

After a few hours the pip on the guidance radar screen began to drift toward the center of the screen. Blutz and I looked at each other and back at the scope. The pip slowly drifted to the center and then right on past it to the other side. A little bit later it drifted back. A quick check with the computers indicated that we were still headed right. And for the next several hours that pip oscillated like that, getting a shade larger each pass.

This kept up until nothing made sense. We had a bright splash that wandered all over the scope. The rocket motors began to cut in and out, and the computers were clicking away. The only instruments that made any sense seemed to indicate that we were in an approach orbit, and that didn't make sense. Apparently the photons had been more potent than calculated and had given us one horrendous shove. We were making the Moon way ahead of

schedule. There was nothing to do but tidy up the loose gear and get buckled down for a landing. In due time with much deceleration and vibration we settled down to the rocks.

We hit much too hard and wound up punchy again. Groggy as we were we scrambled into our walkaround gear like kids going to a party, checked our communicators, air supply, guide lines, hand tools, and shoe laces, and tried to get out for a look. We found that the air-lock pumps were not working. The air lock would not decompress, and we had to let a lot of precious air escape in getting the outer door popped open.

We must have landed in the twilight zone between the light and dark sides of the Moon, because it was not very dark but plenty cold. Our first surprise came when we tried to walk. The Moon was covered with what appeared to be finely powdered ice crystals. At least we slipped and fell like it was ice.

When we were back on our feet we took a good look around. The *Flying Bucket* was a little bent and pocked, but no serious damage was apparent. The moonscape was all a monotonous white with jagged shapes poking up here and there. It was while I was examining a particularly large pile of rocks a few hundred yards away from where we had landed that the creature showed up. He popped out from behind this large shape. I suppose the best way to describe the creature is by saying that it looked like a sailor in arctic gear. I say that because it was a sailor in arctic gear.

Blutz and I were dumfounded. How did the blinking Navy get up here ahead of us?

The sailor said something to me, but I couldn't hear it through my helmet.

"You guys all right?" he yelled up next to my head.

"I guess so," I yelled back. While this high-toned conversation was going on a snow-buggy rumbled up with more Navy people. They loaded us up to take us back to their base.

"How long you been here?" I asked the man next to me.

"Two years, four months, and seven days. When the three years is up I go home," he answered.

"And we thought we would be the first on the Moon," I moaned.

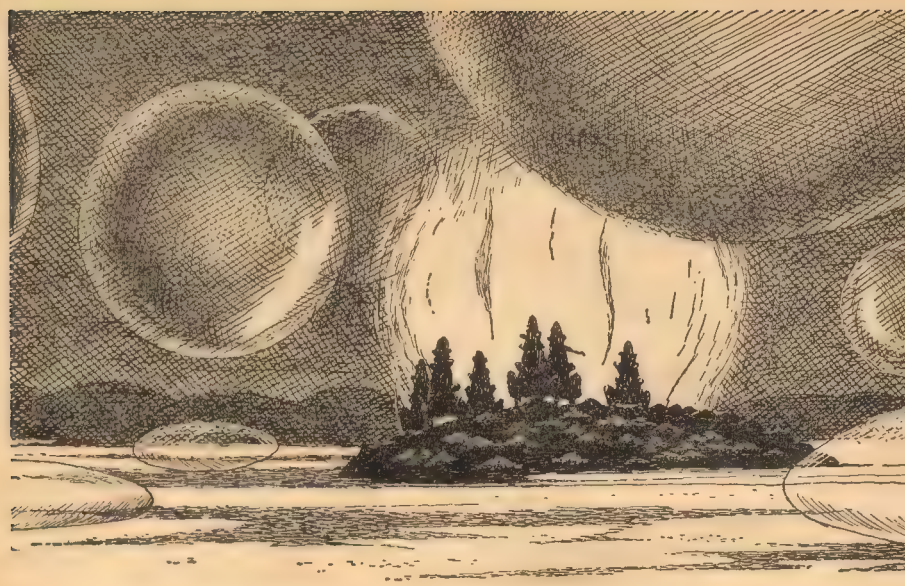
"You may be yet," he said. "You are lucky you came down in one piece and so close to our arctic weather station."

"Weather station!" I was astounded.

"Yes, sir. Nice try though. You'll make it next time."

"There'll be no next time for me," I said emphatically, "or my name is not Murphy."

THE END



CLOSE TO.....

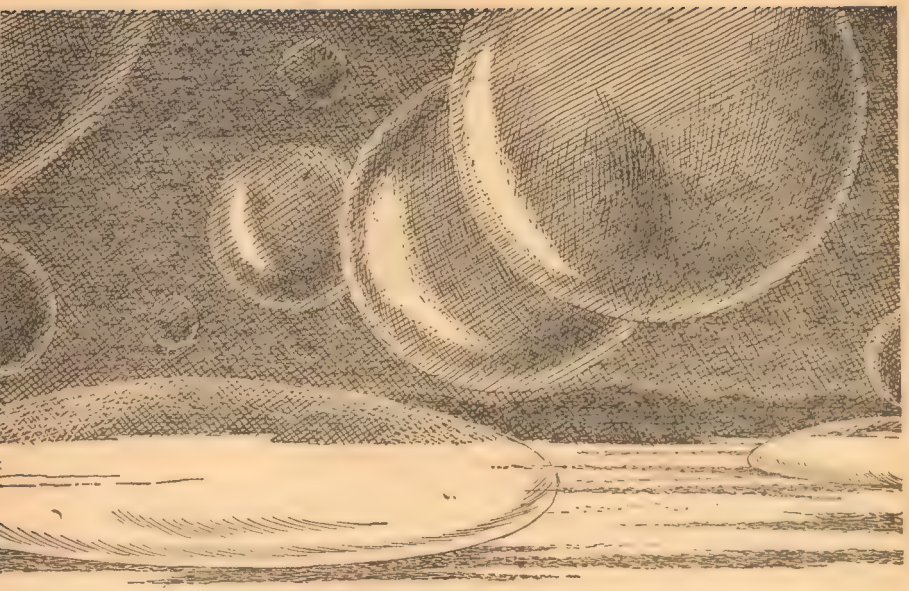
Second of Three Parts. The pressure down on Tenebra was enormous, and practically constant. But the political-psychological pressure in the research station was building up to exceed even Tenebra's frightful pressure!

Illustrated by

van Dongen

SYNOPSIS

The planet Tenebra, *circling the star Altair some sixteen light-years from the Solar system, has presented a major research problem. Its diameter and surface gravity are approximately three times those of Earth. Its temperature in the equatorial regions runs between three hundred seventy and three hundred eighty degrees Centigrade. Since its escape velocity permitted it to retain originally an amount of water per square mile*



....CRITICAL

BY HAL CLEMENT

about equal to that of Earth, the surface atmospheric pressure is about eight hundred times Earth normal. The atmosphere consists principally of water, laced with the biological by-products nitrogen, free oxygen, and, in this rather unusual case, oxides of sulfur.

It is an even more corrosive environment than that of Earth; in spite of the general acidity, the silicate surface rocks of the planet dissolve so rapidly that the crust is in a constant state of isostatic imbalance, and earthquakes are practically continuous.

After much engineering effort, a remote-controlled robot is designed and built capable of operating on Tenebra, and is successfully lowered to the surface. It explores for months, and finally achieves its intended purpose of locating a more or less intelligent indigenous race. The creatures appear to be in a stone-age culture, though only brief observations of them are made at first; when they are found to be egg-layers, the operators of the robot steal ten

of their eggs, carry them to an isolated and uninhabited area, hatch them, and bring up the young creatures with the plan of educating them as go-betweens in the planned human-Tenebran activities of the future.

The story actually opens as this project is about to get under way. The kidnaped natives have been educated for some sixteen years, and are presumed ready for work, though judging by their size they are not yet adult. They do not know their own background, but regard themselves as "Fagin's people," some humorist among the human operators having taught them to call the robot FAGIN. *A vessel patterned after the ancient bathyscaphe is practically completed, ready to carry human explorers in person to Tenebra's surface. Two political officers have come to the* Vindemiatrix, *the robot's "mother ship," to watch the start of the contact operation.*

These officers are Councilor RICH, *a human being, and Councilor* AMINADABARLEE, *a native of Dromm in the Eta Cassiopeia system. Both have brought members of their families, regarding the trip as little more than a routine affair, to be combined with a vacation if possible. The families are* ELISE—"EASY" *Rich, twelve-year-old daughter of the human officer, and* AMINADORNELDO, *son of the Drommian. The latter is physically as large as his father, but is actually about the equivalent of a human seven-year-old.*

On the planet's surface, one of the students has been sent out exploring, deliberately, in a direction likely to bring him into contact with his parent tribe. The student, NICK CHOPPER, *does find the cave dwellers, learns their language after a fashion, and both shows and tells them some of the things he has learned from his teacher "back home"—the use of fire, the keeping of domestic animals, and such items. The leader of the cave tribe,* SWIFT, *has his cupidity aroused, and orders Nick to bring Fagin to the cave village. Nick agrees to do this provided the teacher agrees; Swift, a complete autocrat, takes violent exception to the condition mentioned and starts uttering threats. Nick becomes afraid for the safety of his fellows, and takes the unprecedented step of escaping from the cave village by night.*

At night—Tenebra's rotation period is nearly a hundred hours—enough heat is radiated from the upper layers of the atmosphere to allow it to shift into the liquid phase. This liquid water is enough denser than the still gaseous oxygen for separation to occur, and eventually huge raindrops reach the surface which contain only the truly dissolved oxygen. This is insufficient for active animals, and most Tenebran animal life collapses into more or less suspended animation when struck by one of the "clear" drops which fall after the first few hours of night. Nick is no exception to this rule; but he finds that by carrying torches he

can see to avoid the drops and remain in breathable air. He starts his journey, failing to realize that Swift would cheerfully have let him escape even by daylight so that the cave dwellers could follow him back to Fagin's village. Nick reaches home and reports to his teacher. The human beings realize the situation, but before they can form any plan of action Swift and his people attack. HELVEN RAEKER, *the ecologist in charge of surface activities, watches helplessly while two of his pupils are killed and the village captured. Swift, in spite of the language problem, makes his wishes known to the robot operators; the machine has to go back to the cave village with him, or Swift will use fire on it. Since the destruction of the robot would wreck the entire project—even if another were built, it would take years to locate this particular area again on huge, unmapped, practically featureless Tenebra—the human beings have no choice.*

Nick and the other survivors, contemptuously left behind, move their herd and personal belongings away from the village. They plan to rescue Fagin, and want a base of operations unknown to the cave dwellers. They find a site on a peninsula projecting into a sea to the east of the old village, and set up a camp; unfortunately, no one stops to think what may happen to the sea level at night.

On the Vindemiatrix *the two children have been taken on a sightseeing tour by a crewman. This trip includes a visit to the practically completed bathyscaphe, orbiting just above Tenebra's atmosphere. Failing to realize that Aminadorneldo is not an adult, the guide allows them to enter the ship unattended, and remains in the shuttle rocket which brought them from the* Vindemiatrix. *Raeker, Rich, and Aminadabarlee discover this during a radio conversation with the man; the Drommian becomes virtually hysterical as he points out the "stupid error," and his anxiety is transmitted too well.*

In his haste to get back to the children, the crewman makes the error of touching the bathyscaphe's hull while still in contact with that of the tender; the potential difference is enough to set up a sneak circuit which fires a set of the bathyscaphe's booster rockets—outboard attachments designed to get the ship into an entry orbit when the time came. The crewman is kicked onto one indeterminable vector and lost; the ship onto another.

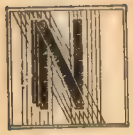
Easy is able to report on the 'scaphe's radio, but before another shuttle can be readied and taken across the hundred and sixty thousand miles between Vindemiatrix *and planet, her ship has entered atmosphere and is no longer interceptible. The elder Drommian can hardly find words to express his opinion of human stupidity; Raeker points out that the ship was made for just such a trip, is perfectly capable of getting down to atmospheric speed under automatic control, and once down has electrolysis apparatus able*

to get hydrogen from Tenebra's atmosphere to fill its buoyancy cells and get back to where rockets will work and an interception be managed. The politicians do feel better for a while, after the ship succeeds in landing after a rough descent. Its automatic pilot, energized by Easy on careful instructions from the Vindemiatrix's *engineers, has brought it down somewhere near the robot, though no one can tell just how near.*

At first no one cares, since it is presumed that the ship can take off again unaided; but when the girl, under the engineers' directions, closes the switches of the electrolyzers, they draw no current.

PART 2

V



ICK had chosen a fire on the landward side of the hill, so he was the first to have to consider the sea-level problem. In the home valley, of course, the water at night had never gotten more than thirty or forty feet deep; slow as the runoff was, enough always escaped at the valley foot to keep the village itself dry. He knew, from Fagin's lectures, that the water which flowed away must eventually reach something like a sea or lake; but not even Fagin had stopped to think of what would happen then—naturally enough; the surface area of Earth's oceans compared to the volume of an average day's rainfall doesn't correspond to much of a sea-level rise, to put it mildly.

On Tenebra, the situation is a trifle different. There is no single giant sea basin, only the very moderate-sized lake beds, which are even less permanent than those of Earth. What this difference could mean in terms of "sea" level might possibly have been calculated in advance, but not by any of Nick's people.

At first, there was nothing to worry about. The great, cloudy drops drifted into sight from far above, settled downward, and faded out as the radiation from the fires warmed them a trifle. Then they came lower, and lower, until they were actually below the level of the hilltop on all sides.

Once a sharp quake struck and lasted for half a minute or more, but when Nick saw that the spit of land joining the hill to the shore was still there he put this from his mind. Something much more unusual was starting to happen. At home, raindrops which touched the ground after the latter had been cooled down for the night flattened into great, foggy half-globes and drifted around until a fire obliterated them; here they behaved differently. Drops striking the surface of the sea vanished instantly and by Nick's standards, violently. The difference in pressure and temperature made the reaction between oleum and water much less noticeable than it would be in an Earthly laboratory, but it was still quite appreciable.

After each such encounter, it could be seen that further raindrops falling on the same area faded out a little higher than usual for a few minutes; Nick judged correctly that some heat was being released by the reaction.

He had been watching this phenomenon for some time, interrupted twice by the need to relight his fire when a particularly close drop smothered it, when he noticed that the hill was now an island. This startled him a trifle, and he turned all his attention to the matter. The quake hadn't done it; he particularly recalled seeing the tombolo intact after the shaking was done. It didn't take him too long to conclude that if the land wasn't sinking, the sea must be rising; and a few minutes' close watch of the shore line proved that something of that sort was happening. He called the others, to tell them of what he had seen, and after a few minutes they agreed that the same thing was happening on all sides of the hill.

"How far will it come, Nick?" Betsey's voice was understandably anxious.

"I don't see how it can get this high," Nick answered. "After all, it hasn't risen as much as the water in our own valley would have by this time of night, and this hill is nearly as high as the village. We're safe enough."

It got a little harder to stick to this belief as the hours passed and the sea grew higher. They could see the pools on shore swell and overflow into the main body; as time went on, more than one great river formed, carrying runoff from no one knew what drainage area. Some of the rivers were frightening, their centers as high or higher than the hill itself before they spread out and merged with the sea. By this time the violence of water-meeting-acid had subsided; the sea, at least near the shore, was pretty dilute.

Of course, "near the shore" might be too casual a statement. No one on the hilltop could tell for certain just where the shore was now. The route they had followed was deep under the acid sea, and the only evidence that dry land existed was the rivers which still came into view above sea level.

The island that had been a hill shrank steadily. The cattle seemed unperturbed, but were driven inside the ring of fires. Then this had to be drawn in—or rather, others built closer to the hilltop; and at last people and animals huddled together behind a single ring of glowing heat, while the sea bulged upward at their feeble protection. The raindrops were clear now; they had fallen from high enough levels to lose their suspended oxygen, and inevitably the last fires succumbed. Their heat had for many minutes past been maintaining a hollow in the surface of the sea; and as they cooled, the ocean reclaimed its own. Seconds after the last spark died every living being on the hilltop was unconscious, and a minute later only a turbulent dimple in the surface of the sea showed

where the slightly warmer hilltop was covered. Nick's last thought was to the effect that at least they were safe from animals; they would be uncovered long before anything could get at them.

Apparently he wasn't quite right. When they woke up the next morning and brushed the thin frost of quartz crystals from their scales, all the people were there, but the herd seemed to have diminished. A count confirmed this; ten cattle were gone, with only a few scales left behind. It was fortunate that the animals were of a species whose scale armor was quite frail, and which depended more on its breeding powers to survive; otherwise the meat-eaters who had come in the night might have made a different choice.

The realization that things lived in the sea came as a distinct shock to the entire party. They knew just about enough physical science to wonder where any such creature got its oxygen.

But the new situation called for new plans.

"There seems to be a catch in the idea of telling Fagin just to hunt along the seashore until he finds us," Nick commented after breakfast. "The seashore doesn't stay put too well. Also, we can't afford to stay near it, if we're going to lose eight or ten per cent of our animals every night."

"What we'll have to do is some more mapping," commented Jim. "It would be nice to find a place protected by sea but which *doesn't* get submerged every night."

"You know," remarked Nancy in a thoughtful tone, "one could find a rather useful employment for this place right here, if the proper people could be persuaded to visit it." Everyone pondered this thought for a time, and the tone of the meeting gradually brightened. This *did* sound promising. Idea after idea was proposed, discussed, rejected or modified; and two hours later a definite —really definite—course of action had been planned.

None of it could be carried out, of course, until it was possible to get off the island, and this was not for a dozen hours after sunrise. Once the tombolo appeared, however, everyone went into furious activity.

The herd—what was left of it—was driven ashore and on inland by Betsey and Oliver. Nick, making sure he had his ax and fire-making equipment, started inland as well, but in a more southerly direction. The other five fanned out from the base of the peninsula and began mapping the countryside for all they were worth. They were to determine as much as possible, no later than the second night following, the area which was submerged by the sea at its highest. The group was then to pick a more suitable camp site to the north of the previous night's unfortunate choice. They were to settle at this point, and send a pair of people each morning to the base of the peninsula until either Nick returned or ten days had passed; in

the latter event, they were to think of something else.

Nick himself had the task of contacting Fagin. He alone of the group was just a trifle unclear on how he was to accomplish his job. Tentatively, he planned to approach the cave village at night, and play by ear thereafter. If Swift's people had gotten into the habit of moving around at night with torches, things would be difficult. If not, it might be easy —except that his own approach would then be very noticeable. Well, he'd have to see.

The journey was normal, with enough fights to keep him in food, and he approached the cliff on the evening of the second day. He had circled far around to the west in order to come on the place from the cliff top; but even so he halted at a safe distance until almost dark. There was no telling where hunting parties might be encountered, since there was a path up the cliffs in nearly constant use by them.

As darkness fell, however, Nick felt safe in assuming that all such groups would be back at their caves; and checking his fire-lighting equipment once more, he cautiously approached the cliff top. He listened at the edge for some time before venturing to push his crest over, but no informative sounds filtered up and he finally took the chance. The cliff was some three hundred fifty feet high at that point, as he well knew; and he realized that even a single spine would be quite visible from below by daylight. It might be somewhat safer now, since no fires appeared to have been lighted yet.

When he finally did look, there was nothing to see. There *were* no fires, and it was much too dark for him to see anything without them.

He drew back again to think. He was sure the village and its inhabitants lay below, and was morally certain that Fagin was with them. Why they had no fires going was hard to understand, but facts were facts. Perhaps it would be safe to try to sneak up to the village in the dark—but the rain would come soon, and that would be that.

Then he had another idea, found some small wood, and went to work with his fire-making tools, a drill and spindle made from tough wood. He rather expected some response from below when he got a small blaze going, since it lighted up the sky more effectively than daylight; but nothing happened until he executed the next portion of the idea, by tossing a burning stick over the edge of the cliff. Then everything happened at once.

The light showed Fagin, standing motionless fifty yards from the foot of the cliff. It showed an otherwise empty expanse of rock and vegetation; the people were in their caves, as usual. That, however, was only temporary.

With the arrival of the fire, a rattle of voices erupted from the caves. Evidently, if they ever slept, they weren't doing it yet. After a

moment Swift's tones made themselves heard above the others.

"Get it! Get wood to it! Don't just stand there as if you were wet already!" A crowd of figures emerged from the rock and converged on the glowing twig; then they spread out again, as though they had all realized at once that no one had any wood and it would be necessary to find some. Plants were wrenched up from the ground by a hundred different hands and carried, or sometimes thrown, toward the spark.

Nick was far more amused than surprised when it went out without anyone's succeeding in lighting anything from it, and was only academically curious as to whether it had burned out of its own or been smothered by its would-be rescuers. His attention was not allowed to dwell on the problem for long; Swift's voice rose again over the disappointed babble.

"There's a glow on top of the cliff, and that's where the fire came from! Someone up there still has some; come and get it!" As usual, obedience was prompt and unquestioning, and the crowd headed toward the trail up the cliff. Nick was a trifle surprised; it was close to rainfall time and the cave dwellers were carrying no fire. Something drastic must have happened, to overcome their lifelong habit of keeping to the caves at night. However, it was hardly the time to speculate on that subject; the cave men were seeking fire, and Nick happened to have all that there was around at the moment.

It took him about five seconds to dream up the rest of his idea. He lighted a stick at his small blaze and started toward the head of the trail from below, lighting all the plants he could reach as he went. When he reached the trail he tossed aside the nearly spent torch he had been using, made himself another which he hoped was small enough to shield with his body, and headed on along the cliff top. If the cave men were satisfied to take some fire, well enough; if they wanted him too, perhaps they'd look along the fire trail he had laid, which would lead them in the wrong direction. He wasn't really hopeful about this, knowing their skill at tracking, but anything seemed worth trying once.

He kept on along the cliff top, toward a point some two miles away where the cliff broke gradually away to the lower level. He was out of direct view from the head of the trail when Swift reached it, but did not let that fact slow him down. Once at the broken-rock region he picked his way carefully down, dodging boulders loosened by a sharp quake, and started back, hiding his little torch as well as he could from anyone overhead. Fifteen minutes after the disturbance had started he was beside Fagin, apparently unnoticed by any of Swift's people.

"Teacher! Do you hear me? It's Nick."

"I hear you, all right. What are you doing here? Did you start this

fuss? What's going on, anyway?"

"I threw the fire down the cliff, yes; I had to make sure you were here. The rest was a by-product. I'm here because we've found a way to get you out of Swift's hands without having to worry about his getting hold of you again afterward."

"That's encouraging. I thought I had a way, too, but troubles have arisen in that direction. I need badly and quickly all the help I can get, and I can't see Swift being very helpful for some time. Let's hear your idea."

Nick described the doings of his people since Fagin had been kidnaped, and dwelt particularly on the geography of the spot where they had spent their first night at the sea.

"We assume," he said, "that you can live under the sea the way you can in rain; so we thought if you fled to this hill, and Swift followed you, he'd be trapped there at night; and while he was asleep you could take away all the weapons of his people—which would be a help anyway, since we're getting so short—and if we couldn't figure out anything else to do with him, just shove him downhill to a point which stays submerged all day."

"Would he last long in such a place?"

"Probably not, as there are animals in the sea that ate some of our cattle; but who cares? He didn't mind killing Tom and Alice, and would have done the same to the rest of us if he'd felt it necessary."

"How about the rest of his people?"

"They helped him. I don't care what happens to them."

"Well, I see your point, but I don't entirely share your view. There are reasons which might make you feel differently, but I can't go into them yet.

"Your plan, if it really rates the name yet, has some good points, but it also has some weak ones. If this place of yours is a day and a half's journey from here even for you, I'm not at all clear how I can keep ahead of Swift long enough to let me reach it; remember, you can travel faster than I.

"Also, now that you've brought them back the fire they'd lost, I'll be very much surprised if it's as easy to get away at night as it would have been before."

"What do you mean? They brought fire with them from our village."

"They brought it, but didn't know how to make one fire except from another. They let what they had go out during the day after we arrived, and have been fireless ever since. They've been doing their best to teach me their language so I could show them how to make more, but I'm having a lot of trouble—for one thing, I can't make some of their shriller noises. Swift's been remarkably patient, though, I must say. Now he'll be even easier to get along with, I should imagine; but he certainly won't be easier to get away from."

"Then maybe I shouldn't have come, Teacher. I'm sorry."

"I'm not. My original plan for getting in touch with you again has already failed, so if you hadn't come we'd be in even worse shape. All I meant was that we have some heavy planning to do before we're out of this mess. You'd probably better get away for a few hours at least, while I think; there's no point in having you caught by Swift, too."

"But how will I get back again? They have fire, now—for that matter, as soon as they come back they'll know I've been here, and probably start tracking me. I'd probably still be in sight, even if I started now; it's beginning to rain, and I can't travel without a torch, and that will be visible for miles. I was expecting you to come with me right away."

"I see your trouble, but don't quite know what to do about it. It's hard to believe that Swift won't be back here in the next few minutes." Fagin paused, as though in thought; Nick still didn't understand clearly that such pauses really meant a tense conference among several men a hundred and sixty thousand miles away. "Look, Nick. There's a good deal of burnable material around, right?"

"Yes."

"And there is only one path from the cliff top, and that a narrow cleft?"

"Yes, not counting the way around—a good four miles."

"Hm-m-m. I could wish it were longer. Do you think you can build

a fire big enough to block the foot of that path for a while, so as to delay them while we get going? You'll have to work fast; they must be coming back by now, I should think, unless they're still looking for you on top."

"I'll try." Nick could see that this was no time for theorizing. "Someone's probably looked over the edge and seen me by now, but there's nothing to lose. If I don't catch up to you, head east northeast until you reach the sea, then follow along its daytime shoreline until you meet the others. I'll do what I can to interfere with Swift's trackers; you'd better get going now."

Nick didn't wait for a reply; he was already racing toward the foot of the cliff trail, gathering fuel as he went. His torch was nearly gone, but he started a rough heap of wood a few yards inside the cleft, and managed to get it burning. Then he hunted around madly, tossing every bit of combustible matter he could find into the four-yard-wide crack.

A raindrop came squeezing its way down the gully and vanished as it neared the fire, but it was early enough in the evening for there still to be a good deal of oxygen in it. Nick was pleased; evidently no torch-bearing cave dwellers were yet on the path, or the drop would have been destroyed much sooner. That gave so much more time.

With the pile big enough to satisfy him, he set off along Fagin's trail. Even Nick could follow it, a five-foot-wide track of flattened and crumbled vegetation, except where it led through hollows already filling with liquid water. He could have gone through these with his torch, since the liquid was still fairly safe to breathe, but chose to detour around. Even so, he caught up with Fagin within a mile.

"Keep going," he said. "I'm going to do a little trail erasing." He applied his torch to a bush beside the trail, and to the crushed, brittle material on the track itself; then he started in a wide arc to the north, setting fire to every bush he passed. Eventually, a glowing belt of radiance extended from Fagin's trail almost east of the cave village around to the track down which the robot had been brought from the north. Nick thought he could hear excited voices from the caves, but wasn't sure. He raced northward at the top of his speed for another mile, and started another series of fires there. They should be visible from the cliff, too; and perhaps the cave dwellers would come out and search along the route to the old village rather than start tracking right away.

Then he raced back to intercept Fagin's trail, shielding his torch with his body in the hope that its glow would not be seen from the cliff. He found the trail with little trouble, though Fagin was sensibly keeping to the valleys as much as possible, and finally caught up with the teacher. Fagin heard his report, and approved.

"It's probably the best you could

have done," he said. "I'll be surprised if we get through the night without having company, though."

"So will I," admitted Nick.

In spite of this pessimism, the hours passed without any sign of pursuit. Nick's higher speed allowed him to keep up with the robot, even though he had to detour puddles which the machine took in its stride. The raindrops grew clear, and correspondingly dangerous; puddles and lakes larger, deeper, and harder to avoid as the bottom of Tenebra's atmosphere gradually underwent its nightly change in phase.

"Even with your staying on dry land and leaving such an open trail, they must be having trouble following by now," remarked Fagin during one of the brief spells when they were together. "A lot of the places where you went must be well under water by now, and they can't be boiling them off with torches at this hour; the water's too clear to let them get away with it. I'm starting to feel a little happier about the whole situation."

"I'm not," said Nick.

"Why not?"

"The pools are getting very big, and some of the valleys ahead are long and deep. I remember the night before last there were some pretty big rivers emptying into the sea. If we meet one of those, and I don't see how we can help it, we're stuck."

"On the contrary, that seems to me the best thing that could happen. Swift can't follow through a river."

"Neither can I."

"Not under your own power. I can carry you, and it's pretty safe; we haven't met any creature in sixteen years capable of living, or at least being active, in clear water—though I must admit I've always been expecting it."

"There were some in the ocean."

"That isn't water, for the most part, except late at night. Anyway, I think we needn't worry about ocean life. You've made me happier than I've been for some time; let's look for one of these rivers."

"All right. I hope you're right." Nick was accustomed enough to being knocked out by oxygen-free water, but somehow didn't like the idea of being carted around like a sack in that state. If Fagin thought it was all right, though . . .

It looked for a while as though he needn't have worried. With the common perversity of the inanimate, once a river was wanted, none could be found. They kept on their original course, knowing the futility of zigzagging over unknown ground, and got closer and closer to the sea; but they actually reached it, not too many hours before day, without finding a river.

They had reached the "shore" far south of the region where the others awaited them; Nick had selected their course so that there would be no question of which way to turn when they reached the coast. He had mapped enough to know what measuring uncertainties could mean.

Without hesitation, therefore, he

directed Fagin to follow the "shore" to the left. They were, of course, far inland from the hill which Nick had planned to use to trap Swift, but that was the least of their troubles at the moment. The chief annoyance was the lack of a river; a second one, which made itself apparent an hour or so after they reached the sea, was the appearance behind them of a distinct glow of light. There was no question what it was; the sun just didn't get that distinct, or even that bright.

"They're gaining on us. I wonder how long my fires delayed them?" muttered Nick when the glow caught his eye. Fagin had not seen it yet, apparently, and Nick saw nothing to be gained in calling his attention to it. He just looked that much more intensely for a river ahead.

The robot finally spotted the light as well, and understood its meaning as clearly as had Nick.

"If they get too close before we find a river, you'd better go on ahead at your best speed; you can probably outrun them."

"What will you do?"

"Go into the ocean."

"Why not take me with you? Won't that be as good as a river?"

"Not according to your own statement. I don't want you eaten right out of my arms, and I'm not very well suited to fighting things off if they attack."

"That's true. I guess your idea is best, then."

As it turned out, though, they didn't have to use it. By the time the glow of Swift's torches had resolved itself into separate points of light, and it could be seen that the cave dwellers were overhauling Fagin and his pupil at a rate that promised a scant hour of further freedom, a bulge had appeared on the landscape ahead; and in another minute or two this had taken on the shape of a low, rounded ridge snaking across the countryside. It had the dark hue of clear water; and well before they reached it there was no doubt that it was a river. Since it reached above Nick's crest, there was no way of telling its width; but it must certainly be wide enough to drown any torches Swift's people might be carrying.

Straight to its edge Fagin and Nick went. Ordinarily such a mass of clear water would be a frightening sight as it oozed slowly by toward the sea; but tonight neither of them felt afraid of it. Nick tossed his torch into it with a carefree gesture, noted with actual glee the way the glow died abruptly from its end, made sure his weapons and fire-drill were securely attached to his harness, and turned to the teacher.

"All right, I'm ready."

The white bulk of the robot slid toward him, and four appendages extended from openings in its smooth carapace. Gripping devices on the ends of these clamped firmly, but not painfully, onto two of Nick's arms and his walking legs, picked him up, and draped him over the machine's back.

"All right, Nick," said Fagin. "Relax. I'll get to high ground as quickly as I can on the other side and dodge raindrops, so you shouldn't be out long. Just relax." Nick obeyed the injunction as well as he could as the machine slid into the river.

His body heat boiled a considerable volume of the liquid into gas as they entered; but the gas was oxygen-free and its physical state made no difference to Nick. He lost consciousness within half a minute.

Swift's warriors reached the spot where the trail entered the river fifteen minutes later. The chief was not philosophical enough to put the incident down to experience.

VI

"How much of a lead will that give you, doctor?"

Raeker answered without taking his eyes from the robot's screens. "Presumably the rest of the night, and a trifle more—however long it takes that river to dry up after sunrise. It's twenty hours or so to sunrise."

"Maybe the plants will grow enough to hide the robot's trail in that time; will they?"

"I'm afraid I have no idea."

"After observing the life of this planet for sixteen years? Really, doctor, I should have supposed you'd know something in that time."

"In all sixteen of those years I never had occasion to note just what kind of vegetation is on the north bank of this river," Raeker retorted a trifle impatiently, "and all I know from Nick about Swift is that he's a good tracker; I have no quantitative information as to just how good. Really, councilor, I know you have been living in Hell the last three weeks; but if you can give only destructive criticism I can say that you won't be helping her much. You're getting to sound like Aminadabarlee."

"I'm glad you mentioned that." Rich did not sound at all offended. "I know, doctor, that it is difficult for you to bear up under Drommian mannerisms; they are a rather impulsive race, and while they are very courteous by their standards, those standards are not quite identical to ours. Aminadabarlee is an unusually restrained member of his race; that is why he holds the position he does; but I must suggest very strongly that you restrain your natural impulse to answer sharply when he gets insulting, as he occasionally does. There is no point in straining his capacity for tolerance. I assure you most solemnly that if he loses his self-control sufficiently to make an emotional report to Dromm, every word he has said about the results to Earth would be literally fulfilled. There wouldn't be a war, of course, but the result of a ninety per cent—or even a fifty per cent—cut in Earth's interstellar trade would be fully as disastrous as any war. You must remember that to most of the races we know, Earthmen and Drommians are equally alien; they are both 'creatures from the stars,' and what

one race says about the other would have quite a ring of authority to most of them. This may sound a trifle exaggerated to you, but this little situation is potentially the most ticklish political and diplomatic affair that has occurred in my lifetime."

That actually took Raeker's eyes from the screen for a moment.

"I didn't realize that," he said. "Also, I'm afraid I must admit that it will make no difference in my efforts to rescue Easy and 'Mina; I was doing my best already."

"I believe that, and I'm grateful; but I had to tell you about the other matter. If Aminadabarlee weren't here it wouldn't have been necessary; but since you can't in decency avoid seeing him, it's very necessary that you understand him. Whatever he says, however intolerant or impatient or downright insulting he may be, you must keep your own control. I assure you he won't take your calmness as a sign of fear; his people don't think that way. He'll respect you the more for it—and so will I."

"I'll do my best," promised Raeker, "but right now I'll be just as glad if he doesn't come in for a few hours. I'm busy juggling Nick across the river, and if you want to regard Nick as *my* child you won't be too far wrong. I don't mind talking as long as everything is going all right, but if I stop in the middle of a sentence don't be surprised. Have you been talking to the kids?"

"Yes. They're bearing up pretty well. It's lucky that Drommian is there; I'm afraid Easy would have let go all over the place if she didn't feel responsible for her 'Mina. He seems to feel that she's keeping everything in hand, so for the moment there's no morale problem. Did I tell you that Mr. Sakkiro found that some of the inspection ports had been left open on the bathyscaphe, so that the electrolysis leads were undoubtedly corroded by outside atmosphere? He has some idea of getting your people down there to do a repair job."

"I know. That's all I can think of at the moment, too; but to do that means I have to find *them,* and *they* have to find the 'scaphe. It's some comfort that the kids can stay alive almost indefinitely down there; the machine will keep them in food, water, and air."

"That's true; but Easy won't last forever under three gravities."

Raeker frowned. "I hadn't thought of that. Have you any medical information on how long she's likely to hold out?"

"None at all. The problem has never come up for such a young person. Adults have stood it for a good many months, I know."

"I see. Well, I should think you'd have a good excuse to be nastier than Aminadabarlee, at that rate. The gravity won't bother his youngster."

"No, but something else will. The synthesizers in the bathyscaphe produce human food."

"So what? Isn't Drommian metabolism like ours? They breathe oxygen, and I've seen them eat our food here on the *Vindemiatrix.*"

"In general, yes; in detail, no. Their vitamin requirements are different, though they do use fats, carbohydrates, and proteins as we do. 'Mina will almost certainly start suffering from vitamin deficiency diseases if he stays there long enough; and like me, his father has no exact medical information."

Raeker whistled, and the frown stayed on his face. Rich thought for a moment that something had occurred on Tenebra to worry him, but the screens still showed nothing but river bed.

The stream must have been fully a mile wide, judging by the time it was taking to cross it. The diplomat remained silent, and watched while the robot forged ahead and, finally, out on the far side of the great watercourse.

It was still raining, of course, and without Nick's torch it was necessary to use a spotlight to locate descending raindrops. After about ten minutes in normal air, Nick began to revive; and when he was once more himself, and had found and kindled a torch, the journey went on as before, except for the lack of anxiety over Swift's whereabouts.

Shortly after this, the relief operator appeared. Raeker didn't want to leave the controls, since the situation below was still rather ticklish, but he knew there was really no choice. The human being didn't live who could maintain decent alertness through a whole Tenebran night. He brought the other man up to date and, with several backward glances, left the observation room.

"I don't think I can sleep for a while," he remarked to Rich. "Let's go back to communications and see how Easy's making out."

"She was asleep a couple of hours ago," replied the girl's father. "That's why I came to see what you were up to. No harm in checking, though." He added after a moment's silence, "I like to be there when she wakes up." Raeker made no comment.

Nothing further had happened, according to the communication watch officer, but the two settled down in view of the bathyscaphe screen. No one had much to say.

Raeker was more than half asleep when Easy's voice came from the set.

"Dad! Are you there?" Rich might have been as drowsy as Raeker, but he answered instantly.

"Yes, dear. What is it?"

"We're moving. 'Mina's still asleep, and I didn't want to wake him, but I thought I'd better tell you."

"Tell everything you can to Dr. Raeker; he's here, and knows Tenebra better than anyone else."

"All right. You remember the first night we landed I thought we were on solid ground and the lake was getting deeper, don't you?"

"Yes, Easy. We decided that the rain was diluting the acid in which you had fallen, so its density was going down and you weren't floating so high."

"That's right. After a while the side windows were covered so we couldn't even see the rain, and each night before morning the top one is covered too; we're entirely under water."

"That's using the word a bit loosely, but I see what you mean. In that case you can't see out at all, I should think; how do you know you're moving tonight?"

"We can see, with the lights on; we're at the bottom of the lake or ocean or whatever it is, and the lights show the rocks and some funny things I suppose are plants. We're going by them slowly, sort of bouncing, and the ship is rocking a little from time to time. I can hear the scrapes and bumps whenever we touch."

"All right. I can't see that it's anything in particular to worry about, though I'd like to know why the change from the last five nights. When daylight comes the extra water will evaporate and you'll float again as usual, assuming you're still in the lake or sea. If, as seems rather likely, you're being carried down a river, you may find yourselves stranded on dry land somewhere when it dries up. At least you'll have a more interesting landscape to watch tomorrow, if that's the case.

"The only problem we have here is locating you. If you're going to start drifting around every night, directing our people to you is going to be hard, to say the least. You'll have to give us every bit of information you can on your surroundings, so we can pass it on to Nick and his friends. You were very smart to call us just now, the moment you discovered you were moving."

"Thanks, doctor. We'll keep our eyes open. I want to meet your friend Nick."

"We're doing our best to see that you do. If, as we hope, you landed within a few dozen miles of the robot, the chances are you're being washed toward the same ocean that gave him trouble a couple of nights ago; we have reason to suspect that oceans don't get very large on Tenebra, at least by Earthly standards, so getting you together may not take too long."

"Maybe I'd better stay awake for a while, so as to report to you if anything special happens, and then let 'Mina take a watch while I sleep."

"That sounds perfect. We'll always have someone listening up here." Raeker opened the mike switch and turned to Rich. The diplomat was eying him intently.

"How much of that was for Easy's morale, and how much for mine?" he asked.

"I made it sound as good as possible," admitted Raeker, "mostly for the kids. However, I didn't lie. I'm reasonably sure I can get my crew to the 'scaphe before too long; I admit I'm less sure what they can do after they find it. We really haven't the slightest idea of the conditions on the outside of that machine, remember; we'll have to wait for

Nick's report before we can decide what instructions to give him."

Rich stared hard at the biologist for a moment, then relaxed slightly. "That sounds reasonable," he said. If he had planned to say any more, he wasn't given the chance.

"It doesn't seem reasonable to me!" The shrill voice needed no identification. "Every human being in this place is dithering a lot of nonsense about teaching a bunch of savages to rewire a machine two thousand years ahead of their culture, and then risk not only a human but a Drommian life on their having done it properly. It's the sheerest nonsense I ever heard. It's hard to believe that anyone over three years old would fail to realize that nothing but another bathyscaphe has the slightest chance of making the rescue, but I haven't heard a single word about such an activity. I suppose men put the expense before the lives involved."

"I haven't heard of any messages proposing such an activity going to Dromm, either," snapped Raeker. "I've heard that it has an industrial capacity at least equal to Earth's, and it's not a parsec farther from Altair. I suppose Drommians don't bother to repair situations that they feel are someone else's fault, whether lives are involved or not."

None of the human beings present could tell just how Aminadabarlee reacted to this; Rich gave him no time to say anything.

"Dr. Raeker, you're forgetting yourself," he said sharply. "If Councilor Aminadabarlee will come with me, I will discuss with him any points of value which may have been hidden in your words, as well as the very valuable suggestion he made himself. If you have any more courteous thoughts to add, get them to me. Please come, sir." The diplomats stalked out, and the watch officer glanced uneasily at Raeker.

"You don't talk to Drommians like that," he ventured at last.

"I know," replied Raeker. "Rich was telling me, a little while ago. I didn't like to do it, but it seemed to me that Rich needed something to take his attention off his kid.

"You're taking a chance. That fellow could easily turn his whole race so anti-Earth that every human trader outside the Solar system would be forced out of business."

"So everyone seems to feel," replied the biologist a trifle uneasily. "I couldn't really believe that things were that critical. Maybe I was a little hasty. Anyway, Rich will be busy for a while, and so will the Drommian; let's concentrate on getting those kids out of trouble. I'll keep my nose out of interracial diplomacy after this."

"Frankly, that relieves me. How about that suggestion—building a new 'scaphe?"

"I'm no engineer," retorted Raeker, "but even I have a pretty good idea how long that would take, even with the experience from the first one to help. I *am* a biologist, and my considered opinion is that both those youngsters would be dead before an-

other bathyscaphe could be made ready. If Rich and the Drommian want to try it, I wouldn't discourage them; the new machine will be useful, and I might even be wrong about the time factors. However, I believe seriously that we will have to run this rescue along the lines already planned."

"And the Drommian was right about those?"

"You mean, that we plan to get Nick's people to make the repairs? Yes. It's not as ridiculous as Aminadabarlee makes it sound. I've been bringing those people up for nearly sixteen years; they're as intelligent as human beings, judging by their learning rate, and they could certainly splice a few wires."

The officer looked doubtful.

"As long as they splice the *right* wires," he muttered. "What will they use for insulation?"

"There's a glue they make—I showed them how, after some experiment—from animal scales. We'll have to make sure it's a nonconductor, but I'm not greatly worried about that."

"Even though you think there's sulfuric acid in their body fluids?"

"I said, not *greatly* worried," admitted Raeker. "The main problem right now is bringing the parties together. You're sure you can't get me

a closer fix on the robot and the 'scaphe?"

"Quite sure. They're putting out different wave lengths, and I have no means of finding the dispersion factor of the planet's atmosphere in that part of the spectrum, let alone getting the precise depth of the atmosphere itself or cutting down the inherent uncertainty of radio directional measurements. The chances, as I told you, are about fifty-fifty that the two are within forty miles of each other, and about nine out of ten that they're not over a hundred miles apart. Better than that I can't do, without radiations neither machine is equipped to transmit."

"All right. I'll just have to get information from Easy, and try to match it in with Nick's maps. At least, they don't have to get too close under our guidance; Nick will be able to see the 'scaphe's lights for miles." The officer nodded, and the two fell silent, watching the live screen. Nothing could be seen in it; if Easy was awake, as she had said she would be, she was not in the control room. Occasionally the men could hear a faint bumping or scraping sound; presumably the ship was still being carried with a current, but no landmark had attracted the girl's attention as being worth reporting.

Raeker finally went to sleep in his chair. The officer stayed awake, but the only message he received was to the effect that Easy was going to sleep and Aminadorneldo was taking over the watch. Nothing excited him, neither, it seemed; the speaker remained silent after the human girl signed off.

For hour after hour the bathyscaphe bumped merrily on its way. Sometimes it stopped for a moment, sometimes for minutes on end; always the journey resumed, as vagaries in the current dislodged it from whatever barred its path. Easy woke up again, and attended to the problem of breakfast. Later she prepared a rather unappetizing dinner—so she said, anyway. Aminadorneldo was polite about it, blaming the deficiencies on the synthesizers. There's not too much one can do with amino acids, fats, and dextrose, even if vitamin powders are available for seasoning. Tenebra's long night wore on; Raeker served another watch in the robot's control room, bringing Nick and Fagin to a point which he believed was fairly close to the rest of the party from the village. A single night on a planet which takes nearly a hundred hours to rotate can become rather boring—though it doesn't have to be, Raeker thought wryly, as he recalled the one when Swift had made his raid.

Things looked up after sunrise—unfortunately, since he was getting sleepy again. Nick definitely recognized the ground over which they were passing, and stated flatly that they would meet his friends in another two hours; Raeker's relief arrived, and had to be given an extremely detailed briefing; and a message came from the communica-

tions room that the bathyscaphe seemed to have stopped.

"Will you please ask Lieutenant Wellenbach if he can have visual communication rigged up between his office and this room?" Raeker asked the messenger who brought this information. "It begins to look as though I'll have to be talking to the bathyscaphe and my pupils at the same time in the near future."

"Certainly, sir," replied the messenger. "There'll be no particular difficulty about that, I'm sure."

"All right. I'm going up to the comm room now to hear Easy's report; I'll come back here when the set is rigged."

"But shouldn't you get some sleep, doctor?" asked his relief.

"I should, but I can't afford to for a while. You stay on duty after I come back, and stop me if I start to do anything really silly."

"All right." The graduate student shrugged his shoulders. Raeker knew he was not being very sensible, but he couldn't bring himself to leave the scenes of action at the moment. He headed for the communication chamber at top speed.

Rich and Aminadabarlee were there. The human diplomat had apparently calmed his Drommian colleague down, at least for the time being, since Raeker's entry produced no fireworks. Easy was speaking as the biologist came in, and he said nothing until she had finished.

". . . Minutes since we last moved. It's no lighter outside, but we're not being rocked so hard; I think the current is weaker. It's after sunrise, if I've been keeping track of time properly, so I guess the water's boiling away." She paused, and Raeker made his presence known.

"I take it, Easy, that neither you nor 'Mina saw any living creatures in the water while you were drifting."

"Nothing but plants, or what I guess were plants."

"How about right now?"

"Still nothing."

"Then my guess is you haven't yet reached the ocean. There were definitely animals there, according to Nick—of course, I suppose they might be frightened by your lights. Would you be willing to put them out for five minutes or so, then turn them on suddenly to catch anything which might have approached?"

"All right, as long as you don't mind the control room lights on. There aren't any windows here, so they shouldn't matter. I'd be afraid to turn them out; I might hit the wrong switch in the dark when it was time to turn them on again."

"You're quite right. I never thought of that."

"I've thought of a lot of things the last three weeks, down here."

For an instant the light-hearted mask she had been holding for the benefit of her young companion slipped a trifle, and all the men saw a miserable, terrified twelve-year old whose self-control was near its limit. Rich bit his lip and clenched his fists; the other human beings avoided his eyes. Aminadabarlee showed no

emotion; Raeker wondered whether he felt any. Then the mask was back in place, and the merry-hearted youngster they had all known before the accident turned to the Drommian child.

"'Mina, will you go to the window in the big lab? Call when you're there, and I'll turn off the outside lights."

"All right, Easy." The long body crossed the men's field of view and vanished again. Then his piping voice came from the other room, and the girl's fingers flicked the light switches.

"Is it dark outside now, 'Mina?"

"Yes, Easy. I can't see anything."

"All right. Tell me if you do; we'll keep it dark for a while. Dr. Raeker, is 'Mina's father there?"

"Yes, Miss Rich." Aminadabarlee answered for himself.

"Perhaps you'd better tell me and Dr. Raeker how long it takes your people's eyes to get used to the dark." Not for the first time, Raeker wondered what combination of heredity and upbringing had given Rich such an amazing child. He had known students ten years her senior whose minds would have been lagging far behind—she was thinking of important points sooner than Raeker himself, and he didn't have her worries . . .

He brought his mind back to the present when she called his name.

"Dr. Raeker, 'Mina couldn't see anything. Maybe five minutes wasn't enough for your sea animals to get over their scare, of course."

"Maybe," admitted Raeker. "Maybe they're just not interested in the bathyscaphe, for that matter. However, I think we'll assume for the present that you haven't reached the sea yet. It will be interesting to see whether you're in a lake or stranded high and dry when the rain evaporates this morning. In either case, get us as complete a description of the country around as you possibly can."

"I know. We'll do our best."

"We're rigging up an arrangement that will let you talk more or less directly to Nick, when you're in a position to give him directions, so you won't have to trust my relaying of your reports. It should be ready soon."

"That's good. I've wanted to talk to him myself ever since I saw you in the robot control room. It looked like fun. But can't I talk to him without going through you, if he finds me? Doesn't this ship have outside mikes and speakers?"

"Oh, yes. Mr. Sakiiro will tell you how to turn them on. This is for the time before he finds you."

"All right. We'll call you again as soon as the water's gone. 'Mina's hungry, and so am I." Raeker sat back and dozed for a few minutes; then he realized that he, too, was hungry, and took care of the situation. By this time he really wanted to sleep; but a call on the intraship system informed him that the communication equipment he had requested was ready for use. Sleepy or not, he had to try it out, so he went back to the robot control room. It

was a good many hours before he left it again.

Nick and Fagin had just rejoined their friends at the new camping spot, and Nick was bringing the others up to date on events. Naturally, Raeker had to listen carefully; there was always the chance that Nick had seen things in a different light from the human observer. It had been known to happen; a human education had not given the Tenebrites human minds.

This time Nick's report showed no signs of such difference, but Raeker had still to learn what the others had done. Since this, as Nick had planned, involved a great deal of mapping, some hours were spent hearing the various reports. It was customary for the maps to be shown to the robot for photographing in the *Vindemiatrix;* then each was explained in detail by the one who had drawn it, since not all the information could be crowded onto the paperlike leaves or summarized in conventional mapping symbols. These verbal accounts were recorded as spoken, and as a rule immediately preempted by the geological crew. Since the present area was very peculiar in that it lay close to the sea and was largely submerged each night, a great deal of time was spent in bringing the men's maps and charts up to date.

Too much time, in fact.

Raeker's relief had not received, perhaps, a really clear idea of the current danger from Swift; and Raeker himself had not given the matter a thought since his return to the observation room. Neither had thought to advise Nick to have anyone on the lookout for danger, and it was sheer chance that the danger was spotted in time.

Jane was telling her tale, and everyone else was listening and comparing her map with their own, then Betsey caught sight of something. It was just for an instant, and some distance away, showing among the shrubs on a hilltop. She knew the teacher could not have seen it; she was aware that her own vision equipment had superior resolving powers to his, though she didn't know the terminology. Her first impulse was to shout a warning, but fortunately before she yielded to it she got a better glimpse of the thing on the hill. That was enough for identification. It was a creature just like herself; and since all of Fagin's community was standing around the teacher, that meant it must be one of Swift's warriors. How he had gotten there so soon after things dried up she couldn't guess at the moment.

Speaking softly so as not to interrupt Jane, she called to Nick and John, who were closest.

"Don't make any move that would let him know you see him, but one of the cave men is watching us from the hill three quarters of a mile west northwest. What should we do about it?"

Nick thought tensely for a moment.

"Just one is all I see. How about you?"

"Same here."

"You've been around here, and I haven't. Is it possible to go down the south or east side of this hill we're on and make a long circuit so as to get on the other side of him without being seen?" Both John and Betsey thought for several seconds, reconstructing in their minds the regions they had mapped in the last day and a half. They spoke almost together, and in almost the same words.

"Yes, from either side."

"All right, do it. Leave the group here casually—you'd both better go together; the herd is on the south side of the hill, and I would judge that some of the beasts are in his line of vision. You can go down and drive them around out of his sight, and we'll hope he thinks you're just doing an ordinary herding job. Once you and the cattle are out of his sight, get around behind him as best you can, and bring him here, preferably alive. I'd like to know how he got here so soon, and so would Fagin, I'm sure."

"Are you going to tell him, or the others?"

"Not yet. They'll act more natural if they don't know. Besides, there are still a couple of reports to be given, and Fagin never likes that to be interrupted, you know."

"I know he usually doesn't, but this seemed a sort of special case."

"Special or not, let's surprise him with your prisoner. Take axes, by the way; they seemed to impress those folks a lot, and maybe he'll give up more easily."

"All right." John and Betsey pulled up their resting legs and started casually downhill toward the herd. None of the others appeared to notice them, and Nick did his best to imitate their attitude as the two scouts disappeared from sight.

VII

Neither Raeker nor his assistant paid any attention to the departure of John and his companion. They were much too busy operating cameras and recorders, for one reason. Easy and her companion could now watch the group on the surface indirectly, but neither of them was familiar enough with the routine activities of Fagin's pupils to notice anything out of the ordinary. Besides, they were paying very close attention to the geographical reports, in the somewhat unreasonable hope of being able to recognize part of the land described.

For the bathyscaphe was now high and dry. The river down which it had been carried had vanished with the coming day, and the ship had rolled rather uncomfortably—though fortunately, very slowly—to the foot of a hillock which Easy had promptly named Mount Ararat. The children were having a little trouble, since they not only had their first visual contact with natives, via the observation room of the *Vindemiatrix,* but also their first look at the solid sur-

face of Tenebra—if one excepts the bottom of a lake and a river. They were covering both scenes as well as they could, one at the windows while the other was at the plate, but each was trying to keep the other filled in verbally on the other part, with confusing results. Their shouted words were coming through to Raeker and the others in the observation room, and were adding their little bit to the confusion there. Raeker didn't dare cut them off, partly for reasons of their own morale and partly because it was always possible that the one at the windows would have something material to report. He hoped the recording of the native reports would be intelligible to the geologists.

Jane finished her account, was asked a question or two by Raeker on points he had not fully taken in, and then settled back to let Oliver show his map. Raeker's assistant photographed it, Raeker himself made sure that the recording tape was still feeding properly, and the two relaxed once more—or came as close to relaxing as the local confusion permitted. Raeker was almost ready to decide that he needn't stay, and to catch up on his overdue sleep.

He had not actually said anything about it, though, when the cave scout caught sight of John. Within three seconds after that, the biologist lost all intention of leaving.

The scout reacted practically instantaneously. He had been crouching as low in the vegetation as his anatomy permitted; now he leaped to his walking legs and started traveling. John was south and west of him, Fagin and the rest south and east; he headed north. Immediately Betsey rose into view in that direction, and he stopped in momentary confusion. Nick, who had never lost sight of the fellow's crest since Betsey had first pointed him out, interpreted the situation correctly even though he could not see John and Betsey. He sprang to his walking legs, interrupting Oliver unceremoniously, and began issuing orders. The others were surprised, but reacted with relatively little confusion; and within a few seconds the whole group was streaming down the hillside toward the point where the cave dweller had vanished, leaving the human observers to shout futile questions through the speakers of their robot.

Seeing that words were useless, Raeker started the robot in the same direction as his pupils, and used language which made Easy raise her eyebrows as the machine was steadily left farther and farther behind. Nick and his friends disappeared over the hilltop where the scout had been hiding, and not even their shouts could be heard over Raeker's voice in the control room.

It was Easy who turned his words into more constructive channels, less because she was shocked than because she was curious.

"Dr. Raeker! Did I hear one of them say that there was a cave dweller to catch? How did one get there so soon? I thought you said you'd

left them behind at that river." Her question was so exactly the one Raeker had been asking himself that he had nothing to say in reply for a moment; but at least he stopped talking, and had the grace to turn slightly red.

"That's what it sounded like to me, Easy. I don't know the way they found us any more than you do; I have always supposed this was a long way outside their home grounds, so I don't see how they could have known a short cut around the river—for that matter, I don't see how there could be such a thing; that river was over a mile wide. We'll have to wait until Nick and the others come back; maybe they'll have a prisoner we can question. I suppose that's his idea; I think he said 'catch,' not 'kill.' "

"That's right; he did. Well, we'll be able to see them in a minute or two, when the robot gets up this hill, unless they've gone over another one in the meantime."

It turned out that they hadn't; the human watchers had a very good view of the chase, not that it was much to see. The valley into which the cave scout had fled was almost entirely ringed with the low, rounded hills so typical of much of Tenebra; John and Betsey had managed to get to the tops of two of these before being seen, so that they had a considerable advantage on the cave man when it came to running. He had made one or two attempts to race out through the wide gaps between Betsey and John and between them and the main group, but had seen after only a few moments on each dash that he was being headed off. When the robot came in sight he was standing near the center of the valley while Fagin's people closed in slowly around him. He was rather obviously getting ready for a final dash through any gap that might present itself, after his pursuers were close enough to have sacrificed their advantage of elevation. He might also be planning to fight; he was two feet taller than Nick and his friends, and had two efficient looking short spears.

Nick seemed to have picked up a smattering of military tactics, not to mention diplomacy, however. He halted his people a good fifty yards from the big cave dweller, and spread them out into an evenly spaced circle. With this completed to his satisfaction, he shifted to Swift's language.

"Do you think you can get away from us?"

"I don't know, but some of you will be sorry you tried to stop me," was the answer.

"What good will that do you, if you are killed?" The scout seemed unable to find an answer to this; in fact, the very question seemed to startle him. The matter had seemed so obvious that he had never faced the task of putting it into words. He was still trying when Nick went on, "You know that Fagin said he was willing to teach Swift whatever he wanted to know. He doesn't want

fighting. If you'll put your spears down and come to talk with him, you won't be hurt."

"If your teacher is so willing to help, why did he run away?" the other shot back. Nick had his answer ready.

"Because you had taken him away from us, and we want him to teach us, too. When I came to your caves to get him, he came with me to help me get away. He carried me through the river, where I could not have gone alone. When you first attacked our village, he wanted us to talk to you instead of fighting; but you gave us no chance." He fell silent, judging that his antagonist would need time to think. However, another question came at once.

"Will you do anything your teacher tells you?"

"Yes." Nick didn't mention the times he had hesitated about obeying Fagin's commands; quite honestly, he didn't think of them at that moment.

"Then let me hear him tell you not to harm me. He is coming now. I will wait here, but I will keep my weapons, until I am sure I won't need them."

"But you don't know his language; you won't know what he's telling us."

"He learned a few of our words while he was with us, though he couldn't say them very well. I think I can ask him if he is going to hurt me, and I'll know if he says yes or no." The scout fell silent and stood watching the approach of the robot, still keeping a firm grip on his spears with two hands each. He was ready to stab, not throw.

Even Raeker could see that readiness as the robot glided into the circle, and felt a little uneasy; he would be a good two seconds slow in reacting to anything that happened. Not for the first time, he wished that the *Vindemiatrix* were orbiting just outside Tenebra's atmosphere, with three or four relay stations to take care of horizon troubles.

"What's happened, Nick? Is he going to fight?"

"Not if you can convince him it isn't necessary," replied Nick. He went on to give a precis of the scout's recent statements. "I don't quite know what to do with him myself, now that we have him," he finished.

"I wouldn't say you really had him, yet," was Raeker's dry rejoinder, "but I see the problem. If we let him go, Swift will be on us in a matter of hours, or in a day or so at the outside. If we don't, we'll have to keep a continuous watch on him, which would be a nuisance, and he might get away anyway. Killing him would of course be inexcusable."

"Even after what happened to Alice and Tom?"

"Even then, Nick. I think we're going to have to put this fellow to a use, and face the fact that Swift will know where we are. Let me think." The robot fell silent, though the men controlling it did not; plans were being proposed, discussed, and

rejected at a great rate while the natives waited. Easy had not been cut off, but she offered no advice. Even the diplomats, able to hear from the communication room which they still haunted, kept quiet for once.

The cave dweller, of course had been unable to follow the conversation between Nick and the teacher, and after the first minute or so of silence he asked for a translation. Somehow he managed to make the request in such a way that Nick felt he was repairing an omission rather than granting a favor when he provided the requested information.

"Fagin is deciding what is best to do. He says that we must not kill you."

"Have him tell me that himself. I will understand him."

"One does not interrupt the teacher when he is thinking," reproved Nick. The cave dweller seemed impressed; at least, he said nothing more until the robot came back on the air.

"Nick." Raeker's voice boomed into the dense atmosphere, "I want you to translate very carefully what I have to say to this fellow. Make it word for word, as nearly as the language difference will allow; and think it over yourself, because there will be some information I haven't had time to give you yet."

"All right, teacher." Everyone in the circle switched attention to the robot; but if the scout in the center realized this, he at least made no effort to take advantage of the fact. He, too, listened, as intently as though he were trying to make sense out of the human speech as well as Nick's translation. Raeker started slowly, with plenty of pauses for Nick to do his job.

"You know," he began, "that Swift wanted me at his place so that

I could teach him and his people to make fires, and keep herds, and the other things I have already taught my own people. I was willing to do that, but Swift thought, from something Nick said, that my people would object, so he came fighting when it wasn't necessary.

"That's not really important, now, except for the fact that it delayed something important to Swift as well as to us. Up until now, all I've been able to give is knowledge. I was the only one of my people here, and I can never go back where I came from, so that I couldn't get more things to give.

"Now others of my people have come. They are riding in a great thing that they made; you haven't any words for it, since I never gave them to Nick's people and I don't think Swift's have any such things. It was something we made, as you make a bucket or a spear, which is able to carry us from one place to another; for the place from which I came is so far away that no one could ever walk the distance, and is far above so that only a floater could even go in the right direction. The people who came were going to be able to come and go in this machine, so that they could bring things like better tools to all of you, taking perhaps things you were willing to give in exchange. However, the machine did not work quite properly; it was like a spear with a cracked head. It came down to where you live, but we found that it could not float back up again. My people cannot live outside it, so they aren't able to fix it. We need help, from Nick's people and, if you will give it, from yours as well. If you can find this machine in which my friends are caught, and learn from me how to fix it, they will be able to go back up once more and bring things for you all; if you can't or won't, my people will die here, and there will not even be knowledge for you—for some day I will die, too, you know.

"I want you to take this message to Swift, and then, if he will let you, come back with his answer. I would like him and all his people to help hunt for the machine; and when it is found, Swift's people and Nick's can help in fixing it. There won't need to be any more fighting. Will you do that?"

Nick had given this talk exactly as it came, so far as his knowledge of Swift's language permitted. The scout was silent for half a minute or so at the end. He was still holding his spears firmly, but Raeker felt that his attitude with them was a trifle less aggressive. It may have been wishful thinking, of course; human beings are as prone to believe the things they wish were true as Drommians are to believe what occurs to them first.

Then the scout began asking questions, and Raeker's estimate of his intelligence went up several notches; he had been inclined to dismiss the fellow as a typical savage.

"Since you know what is wrong with your friends and their machine,

you must be able to talk to them some way."

"Yes, we . . . I can talk to them."

"Then how is it you need to look for them? Why can't they tell you where they are?"

"They don't know. They came down to a place they had never seen before, and floated on a lake for five days. Last night they drifted down a river. They were at the bottom, and couldn't see where they were going; and anyway they didn't know the country—as I said, they never saw it before. The river is gone now, and they can see around, but that does no good."

"If you can hear them talk, why can't you go to them anyway? I can find anything I can hear."

"We talk with machines, just as we travel. The machines make a sort of noise which can only be heard by another machine, but which travels very much farther than a voice. Their machine can talk to one in the place where I came from, and then that one can talk to me; but it is so far away that it can't tell exactly where either of us is. All we can do is let them tell us what sort of country they can see; then I can tell you, and you can start hunting."

"You don't even know how far away they are, then."

"Not exactly. We're pretty sure it's not very far—not more than two or three days' walk, and probably less. When you start looking for them we can have them turn on their brightest lights, like these"—the robot's spots flamed briefly—"and you'll be able to see them from a long distance. They'll have some lights on anyway, as a matter of fact."

The cave dweller thought for another minute or so, then shifted the grip on his spears to "trail." "I will give your words to Swift, and if he has words for you they will be brought. Will you stay here?"

The question made Raeker a trifle uneasy, but he saw no alternative to answering "yes." Then another point occurred to him.

"If we did not stay here, would it take you long to find us?" he asked. "We noticed that you got to this side of the river and into sight of our group much more quickly than we had expected. Did you have some means of crossing the river before day?"

"No," the other replied with rather surprising frankness. "The river bends north not far inland from the place where you walked through it and goes in that direction for a good number of miles. A number of us were sent along it, with orders to stop at various points, cross as soon as it dried up, and walk toward the sea to find traces of you."

"Then others presumably crossed our trail—all those who were stationed farther south—and located us."

"No doubt. They may be watching now, or they may have seen you attack me and gone off to tell Swift."

"You knew about the bend in the river. Your people are familiar with

the country this far from your caves?"

"We have never hunted here. Naturally, anyone can tell which way a river is going to flow and where there are likely to be hills and valleys."

"What my people call an eye for country. I see. Thank you; you had better go on and give the message to Swift before he arrives with another crowd of spears to avenge the attack on one of his men."

"All right. Will you answer one question for me first? Sometimes you say 'I' and sometimes 'we' even when you obviously don't mean yourself and these people here. Why is that? Is there more than one of you inside that thing?"

Nick did not translate this question; he answered it himself.

"The teacher has always talked that way," he said. "We've sometimes wondered about it, too; but when we asked him, he didn't explain—just said it wasn't important yet. Maybe Swift can figure it out." Nick saw no harm in what he would have called psychology if he had known the word.

"Maybe." The scout started south without another word, and the rest of the group, who had long since broken their circle and gathered around the teacher, watched him go.

"That sounded good, Dr. Raeker. Should we keep the spotlights on just in case, from now on?" Easy Rich's voice broke the silence.

"I wouldn't, just yet," Raeker said thoughtfully. "I wish I could be sure I wanted Swift to find you, instead of merely wanting to keep him from attacking us."

"What?" Aminadabarlee's voice was shriller, and much louder, even than usual. "Are you admitting that you are using my son as bait to keep those savages away from your little pet project down there? That you regard those ridiculously-shaped natives as more important than a civilized being, simply because you've been training them for a few years? I have heard that human beings were cold-blooded, and scientists even more so than the general run, but I would never have believed this even of human beings. This is the absolute limit. Councilor Rich, I must ask your indulgence for the loan of our speedster; I am going to Dromm and start our own rescue work. I have trusted you *men* too long. I am through with that—and so is the rest of the galaxy!"

"Excuse me, sir." Raeker had come to have a slightly better grasp of the problem the Drommian represented. "Perhaps, if you do not trust me, you will at least listen to Councilor Rich, whose daughter is in the same situation as your son. He may point out to you that the 'ridiculous natives' whose safety I have in mind are the only beings in the universe in a position, or nearly in a position, to rescue those children; and he may have noticed that I did not tell the savage even the little I heard of Easy and 'Mina's description of the country around

them. I am sure we will appreciate your planet's help, but do you think it will possibly come in time? Before the human girl is permanently injured by extra gravity, and your son has exceeded your race's time limit under vitamin and oxygen deficiency? I am not asking these questions to hurt you, but in an effort to get the best help you can give. If there is anything more you can do than keep your son's courage up by staying where he can see and hear you, please let us know." Rich's face was visible behind the Drommian's in the jury-rigged vision screen, and Raeker saw the human diplomat give a nod and an instantly suppressed smile of approval. He could think of nothing to add to his speech, and wisely remained silent. Before Aminadabarlee found utterance, however, Easy came in with a plea of her own.

"Don't be angry with Dr. Raeker, please; 'Mina and I can see what he's doing, and we like Nick, too." Raeker wondered how much of this was true; he wasn't as sure himself as he would like to have been of what he was doing, and the children had not yet talked directly to Nick, though they had been listening to him and his people for a couple of hours. Easy, of course, was a diplomat's daughter. Raeker had learned by now that her mother had died when she was a year old, and she had traveled with her father ever since. She seemed to be growing into a competent diplomat in her own right. "It doesn't really matter if Swift does find us," she went on. "What can he do to hurt us, and why should he want to?"

"He threatened to use fire on the robot if it didn't come with him to the cave village," retorted the Drommian, "and if he does the same to the 'scaphe's hull when you fail to tell him something he wants to know, you'll be in some trouble."

"But he knew that Fagin didn't speak his language, and was very patiently teaching it during the three weeks or so it was in his power; why should he be less patient with us? We're perfectly willing to teach him anything we know, and we can talk to him with less trouble than Dr. Raeker could—at least, there won't be the delay."

A burst of shrill sound from Aminadorneldo followed and, presumably, supported Easy's argument; Aminadabarlee cooled visibly. Raeker wondered how long it would last. At least, things were safe politically for the moment; he turned his attention back to Tenebra and Nick.

That worthy had started his group back toward the original meeting place, with two running ahead—the herd had been unprotected quite long enough. Nick himself was standing beside the robot, apparently waiting for comment or instructions. Raeker had none to give, and covered with a question of his own.

"How about it, Nick? Will he come back? Or more accurately, will Swift go along with us?"

"You know as well as I."

"No, I don't. You spent a long

time with Swift and his people; you know him if any of us do. Was I right in playing on his desire for things we could bring him? I realize he wanted to know about things like fire, but don't you think it was for what he saw could be done with it?"

"It seems likely," admitted Nick, "but I don't see how it's possible to be sure of what anyone's thinking or what he's going to do."

"I don't either, though some of my people keep trying." The two started after the rest of the group, scarcely noticing the minor quake that snapped a few of the more brittle plants around them. Nick almost unthinkingly gathered firewood as he went, a habit of years which had developed in the old village after the more accessible fuel near the hilltop had been exhausted. He had quite a stack in his four arms by the time they rejoined the others. This was piled with the rest; the herd was checked and the strays brought back together; and then Fagin called a meeting.

"You all heard what I told Swift's man, about the machine which was stranded somewhere here with some of my people in it. If it is not found and fixed shortly, those people will die. You know as well as I that rescue of people in danger is of more importance than almost anything else; and for that reason, we are going to drop all other activities, except those needed actually to stay alive, while we look for that ship.

"I will give you a description, as completely as possible, of the place where they are. We'll check all our maps for similarity—I'll help you there; I can do it faster—and then you'll go out in pairs to check all likely spots. If we don't find them, mapping will proceed as rapidly as possible, to the exclusion of all other scientific activities.

"For the rest of today, Betsey and Nick will take care of camp and herd; search teams will be Oliver and Dorothy, John and Nancy, and Jim and Jane. I will assign an area to each of the teams as soon as the maps have been checked; in the meantime, you might all be gathering firewood for tonight." The group scattered obediently.

The geologists in the *Vindemiatrix* had for some time been matching, or trying to match, Easy's not too complete description of the bathyscaphe's environs; they had come up with four or five possible locations, none of which made them really happy. However, when a sixth possibility was finally settled on, Racker called the exploring teams back to the robot and assigned two of the hopeful areas to each team. These were all in the general direction of the old village, naturally, since the mapping had gone on radially from that point in the two or three years the cartography project had been going. They were all on the nearer side of that region, however, since the men who had done the matching had been influenced by the realization that the 'scaphe must have drifted seaward on the night that it

moved. It seemed likely, therefore, that a day to go, a day to explore, and a day to return would suffice for this step of the plan. By that time, Swift might be back with his people, and the rate of search could be stepped up. That was why Nick had been kept behind at the camp site; he might be needed as an interpreter.

The instructions were heard, the villagers' own maps were checked, weapons were examined, and the parties set out. Nick and Betsey, standing beside the robot, watched them go; and far away, Raeker finally left the observing room to get some sleep. The diplomats stayed awake, chatting with their children as the latter described the animals which came into sight from time to time. In this relatively dull fashion the rest of the ship's day, a night, and part of another day were spent, while the search teams plodded sturdily toward their assigned areas.

This was the twenty-seventh ships' day since the accident to the bathyscaphe, the afternoon of the seventh day as far as Nick and his people were concerned. The children were understandably impatient; both fathers had to explain again and again how small were their chances of being found at the very beginning of the search. For this day, at least, human and Drommian were in remarkably close accord. In spite of this unity of effort, however, the children tended to spend more and more time at the windows as the day drew on, and from time to time even Easy brought up the subject of using the spotlights to guide the searchers who should be approaching. Her father kept reminding her that Raeker had advised against it; but eventually Raeker withdrew his objection.

"It'll make the kid feel more part of the operation," he said in an aside to Rich, "and I can't see that there's much, if any, more chance of Swift's sighting them than of our own people's doing it at the moment. Let her play with the lights."

Easy happily made full use of the permission, and the bathyscaphe blazed far brighter than daylight—since daylight was utter darkness to human eyes, at Tenebra's surface. Rich was not too happy about the permission; it seemed to him encouraging the youngster in her unreasonable hope of an early rescue, and he feared the effects of disappointment.

"Listen to them," he growled. "Yelling to each other every time something moves within half a mile. If they could see any farther it would be still worse—thank goodness they are using their eyes instead of the photocells of the robot. That'll last until they get sleepy; then they'll start again when they wake up—"

"They should be under water by then," pointed out Raeker mildly.

"And drifting again, I suppose. That's when everything will go to pieces at once, and we'll have a couple of screaming kids who'll probably start hitting switches right and left in the hope some miracle will bring them home."

"I don't know about the Drommian, but I think you do your daughter a serious injustice," replied Raeker. "I've never known much about kids, but she strikes me as something pretty remarkable for her age. Even if you can't trust her, you'd better not let her know it."

"I realize that, and no one trusts her more than I do," was the weary answer. "Still, she *is* only a kid, and a lot of adults would have cracked before now. I can name one who's on the edge of it. Listen to them, down there."

Aminadorneldo's piercing tones were echoing from the speaker.

"There's something on this side, Easy! Come and see this one."

"All right, 'Mina. Just a minute." Easy's small form could be seen for an instant on the screen, passing through the control room from one side of the ship to the other, calling as she went, "It's probably another of those plant-eating things that are about as big as Nick's people. Remember, the ones we want stand up on end."

"This one does. Look!"

"Where?" Aminadorneldo must have been pointing; there was a moment of silence; then the girl's voice, "I still don't see anything; just a lot of bushes."

"It looked just like Nick. It stood beside that bush for a moment and looked at us, and then went away. I saw it."

"Well, if you were right, it'll come back. We'll stand here and watch for it."

Rich looked at Raeker and shook his head dismally.

"That'll—" he began, but got no farther. His sentence was interrupted by a sudden shriek from the speaker, so shrill that for a moment neither of them could tell who had uttered it.

VIII

John and Nancy made steady progress into the west. Their journey so far had not been particularly difficult, though most of it had been made over ground not yet surveyed. They had fought with floaters and other carnivores a reasonable number of times, eaten the fruits of their victories when they felt hungry enough, and talked more or less incessantly. The talk was mostly speculation; they had learned more about the nature of their teacher in the last few days than in the preceding sixteen years, but what they had learned seemed only to give rise to more questions. They were young enough to be surprised at this; hence the steady conversation, which was interrupted only by their reaching a region which seemed to match part of their map.

"We must have kept our direction pretty well," Nancy said after comparing the hills around them to those indicated on the sheet. "We were trying to hit the mapped region about here," she pointed, "and seem to be only a dozen miles to the north. Oliver mapped this place; it hasn't changed enough to be really

doubtful. We can head south, and be sure of ourselves in a few more miles."

"All right," agreed John. "You know, even if we are still a good many miles from either of our search areas, it wouldn't actually hurt to keep our eyes open for the machine."

Nancy sent the ripple that passed for a shrug flickering down her scales. "It's hardly worth making a special effort. We'll be able to see it miles away, if it's as bright as Fagin said. I think we'd better concentrate on the map, just now, until we're sure we're where we're supposed to be."

"Fagin would have had something to say about that sentence," muttered John, "but I suppose you're right. Let's get on."

Two miles, twenty-five minutes, one brief fight and one longish quake later they were in a position to feel sure of themselves. Uniform as the solution molded surface of Tenebra was, and rapid as its changes were, the present region matched the maps too closely to be coincidence. They spent a few minutes deciding whether it would be better to start gathering firewood for the night which was not too many hours away or move closer to their first search area so as to waste less time in the morning, settled on the second alternative, and went on.

Nightfall was even closer when they stopped simultaneously. Neither needed to speak, since it was quite evident to both that they had seen the same thing. Far to the south and somewhat to the west a light was shining.

For several seconds they stood looking at it. What they could see was not particularly brilliant—it was just enough to be noticeable; but light other than daylight on Tenebra can be explained only in a certain very few ways. So, at least, Fagin's students supposed.

After a moment's staring, they got out the maps once more and tried to judge where the source of the light might be. This was difficult, however, because it was next to impossible to estimate the distance. The source itself was not directly visible, just the glow which fires, spotlights, and Altair itself produced in Tenebra's soupy envelope. The direction was plain enough, but it seemed likely that the actual source was either outside mapped territory altogether or in the poorly covered region Nick had done during the trip which had discovered the cave village. It seemed equally likely that they could not possibly reach the place before rainfall, but after the briefest of discussions they agreed to start out.

The going was normal at first, but gradually got rougher. This agreed with what they remembered of Nick's report on his trip. They also recalled his mention of a life form which lived in holes and was dangerous to passers-by, but they encountered no sign of it just then. The light kept getting brighter, which was encouraging, but for several hours they failed to get any better idea of what was making it.

Then they began to get an impression that it was coming from a point above their level, and after another half hour they were both quite sure of this. The fact was hard to understand; Fagin had said that the bathyscaphe couldn't fly because it was broken, and there had been no mention of a hill—at least, not of anything unusual in that respect—in the description of the machine's environment. As a matter of fact, they recalled, it had been stated to lie at the *foot* of a hill.

Then John remembered Nick's tale of a remarkably high hill in the region, and the two got out their maps once more. It seemed possible though far from certain, after careful checking, that the light was on the hill; but if that were the case it seemed to dispose of any remaining chance that they had found the bathyscaphe. Since the only other possibility they could envision was that Swift's people were there with a fire, a slight problem developed.

It would be raining before long, and travel without torches would be impossible. If the area ahead were actually a camp of Swift's cave dwellers, approaching it with torches would be simply asking for capture. Of course, the chief might have accepted Fagin's offer, so that they would technically be allies; but from what John and Nancy knew of Swift they didn't want to take the chance. From one point of view, there was no reason to approach at all, since they were searching for the bathyscaphe rather than scouting the cave men; but this phase of the matter didn't occur to either of them. If it had, they would probably have insisted that they weren't *sure* the light wasn't from the crippled machine. Anyway, they kept trying to plan a method of approach to the light.

It was Nancy who finally worked it out. John didn't like the plan and didn't trust it. Nancy pointed out truthfully that she knew more physics than he did, and even if he didn't know what she was talking about he ought to take her word for it. He replied, equally truthfully, that he might be a mathematician rather than a chemist but even he knew enough about rain not to accept ideas like hers uncritically. Nancy finally won her point by the simple process of starting toward the light alone, giving John the choice of coming or staying behind. He came.

Raeker would have liked to hear that argument. He had named the little creatures who had emerged from the stolen eggs quite arbitrarily, and still had no idea of the actual gender of any of them. Nancy's display of a human-feminine characteristic would have been fascinating if not very conclusive.

John watched the sky uneasily as they strode onward. Inwardly he knew perfectly well that the rain was not due for a while yet; but the mere fact of Nancy's defiance of the phenomenon made him abnormally conscious of it. By the time the first drops actually appeared far above, they were close enough to

the light to see that something lay between them and the actual source —it was shining from behind a barrier of some sort, presumably a hill.

"Should we go over, or around?" John asked, when this fact became evident. "If we go up, we'll run into the rain sooner."

"That's a good reason for doing it," retorted Nancy. "If it is the cave people, they won't be expecting us from that direction, and you'll see all the sooner that I'm right. Besides, I've never been up a really high hill, and Nick said this one was two or three hundred feet tall—remember?"

"I remember, but I'm not as sure as you seem to be that this is the hill he was talking about."

"Look at your map!"

"All right, I know we're close to it, but his notes were pretty rough; you know that as well as I do. There never was time to make a decent map of the country he covered, after he got back. We've been fighting or moving practically ever since."

"All right, you needn't make a thesis out of it. Come on." She led the way without waiting for an answer.

For some time there was no appreciable rise in the general ground level, though the number of ordinary hillocks remained about as usual. The first implication that Nancy might be right about the nature of the hill was a change in the nature of the ground underfoot. Instead of the usual feldspar-rich granitic rock, heavily pitted with solution cavities, a darker, much smoother material became predominant. Neither of them had ever seen fresh lava, since Nick had brought back no specimens, and it took time for their feet to get used to it.

The rain was getting very close to the surface now. There was no difficulty in dodging drops, since there was more light coming from ahead than Altair gave at high noon; the trouble was that Nancy was not bothering to dodge them. Theoretically she was right enough; they were still cloudy with oxygen bubbles, and her body heat turned them into perfectly breathable air, but it took a while for John to follow her example. Habits are as hard to break for Tenebrans as for human beings.

Gradually the slope of the dark rock began to increase. They *were* on a hill, and the light was close ahead, now. Rocks were silhouetted sharply against it, not more than a mile in front. Nancy stopped, not because of the rain but to take a final look around; and it was then that they both noticed something else.

In the first place, the raindrops were not falling straight; they were drifting horizontally as they descended, drifting in the same direction as the two were traveling. That was reasonable when one stopped to think; they had known about convection and advection currents almost as long as they could remember. It was the speed that was remarkable; the drops were heading toward the fire at a good two miles an hour. The air current that impelled them

could actually be *felt*—and that was a major hurricane, for Tenebra. If the thing ahead was a fire, it was a bigger fire than Fagin's pupil's had ever lighted or ever seen.

"If Swift lighted that, he must have touched off a whole map section," remarked John. Nancy turned to him abruptly.

"Johnny! Remember what happened last night, when Nick got the teacher away from the caves! He *did* light fires over a good part of a section! Do you suppose they could still be burning, and have spread like this?"

"I don't know." John stood still and thought for a moment or two. Then he referred to the map, easily legible in the brilliant light. "I don't see how it could be," he said at length. "We're a lot closer to the caves than we were this morning, but not that close. Besides, the clear rain late at night should have put any fire out if there was no one to tend it."

"But if it were big enough, maybe it would stir up the air so there was always enough oxygen for it—feel this wind on our backs. Have you ever known anything like it?"

"No. Maybe you're right. We can go on and see, though; I still think it's more likely to be Swift. Are you still going to try that idea of yours?"

"Of course. It's all the better, with the wind carrying the drops as fast as this."

"I hope you're as right as you are reasonable." The two went on, somewhat more slowly since it was necessary to follow a rather tortuous path to keep their goal in sight among the drops. These were now reaching the surface in great numbers and remaining liquid, except for those parts most closely exposed to the body heat of the two travelers. It took a little longer than might have been expected, therefore, to get within two hundred yards of the rocks ahead, which from the absence of anything but light beyond them appeared to mark the top of the hill. At this point, Nancy decided that stealth was in order; so she brought the scary part of her plan into operation.

Finding an exceptionally large and still cloudy raindrop drifting downward at no great distance, she deliberately placed herself so as to be enveloped by it as it landed. Naturally, the bottom portion of the fifty-foot spheroid was obliterated at once by her body heat; but further descent of the drop finally hid her from view. The great, foggy blot of liquid began to follow the general pattern of activity of the others, moving slowly toward the light; and Nancy did her best to follow. This was not as easy as it might have been, even though the gas around her was perfectly breathable, since with no view of her surroundings it was nearly impossible to judge the rate of drift of the raindrop. The wind was some help, but not enough, and several times John could see her outline as she came too close to the edge of the volume of fog. He stayed where

he was, not considering it cowardly to see how the experiment turned out before he tried it himself.

In one sense, the trial was a perfect success; that is, Nancy remained conscious as long as the drop lasted. In another, however, there was something lacking. This lay in the failure of the drop to last long enough. Suffering the assault of heat radiation both from Nancy within and the fire ahead, the thing abruptly faded out in a final surge of turbulence, leaving her in full view.

This turned out to be less of a catastrophe than it might have been. For three or four seconds after the vanishing of her concealment Nancy stood perfectly still; then she called out, making no effort to direct her voice away from the light ahead, "Johnny! Here, quick!"

Her companion leaped forward, taking a little but not much less care to dodge raindrops, and came to a halt at her side.

She had stopped perhaps five yards from the edge of a nearly vertical-sided pit, fully two miles across. Her first few seconds of silence had been spent in telling herself how lucky she was that her shelter had not lasted a few seconds longer; then the blast of radiant heat coming from the floor of the crater, a scant hundred feet below, forced her to admit the matter was hardly one of luck. It could be seen from this vantage point that no raindrops at all approached the area except those which drifted up the slope of the hill from outside. The floor glowed visibly all over, and numerous patches were of almost dazzling brilliance. These last looked suspiciously like liquid, though the liquid possessed a remarkably sharp and well-defined surface.

Raeker, or even Easy, would have recognized a volcano at once; but the phenomenon was completely outside the experience and education of Fagin's pupils. Raeker had noted, in passing, Nick's earlier reference to the conical shape of the high hill he had reported; the geologists had also paid some attention to it, and even placed it on the list of things to be investigated more fully; but that was as far as matters had gone. Nick had said nothing to suggest that the thing was active—or rather, nothing the men had recognized as such evidence; he *had* mentioned wind. As a matter of fact, it had not been nearly so violent when he had passed some three Terrestrial months before. Only its size and shape had been worthy of note.

"You know," John remarked after some minutes of silence, "this would be a wonderful place for a village. We wouldn't need to keep fires going."

"How about food?" countered Nancy. "The plants growing on this dark rock are different from the ones we're used to; maybe the cattle would not eat them."

"That would be easy enough to find out—"

"Any way, that's not the assignment just now. This light obviously isn't what we're looking for, though

I admit it's interesting. We'd better get on with the job."

"It's raining," John pointed out, "and there was no suggestion that we should search through the night as well as by day. This would seem a perfect place to sleep, at least."

"That's true enough—" Nancy's agreement was interrupted suddenly. Some three hundred yards to their left, a segment of the pit's edge about fifty yards long and ten or fifteen deep cracked loose with a deafening roar and plunged downward. In that gravity even Tenebra's atmosphere was an ineffective brake, and a good ten or fifteen thousand tons of well-cemented volcanic detritus made its way effortlessly through the red-hot crust of nearly solid lava at the foot of the ledge. The results left no doubt about the liquid state of the hotter material—or would have left none had the two explorers still been watching. They weren't; they were on their way downhill in the direction from which they had come before the mass of rock was completely detached. Even as he ran, John had time to feel lucky that the incident had waited until Nancy had agreed with him about what a good camping spot the place was. Needless to say, he did not mention this aloud. Even John was not bothering to dodge raindrops at the moment, much less talk on irrelevant subjects.

They covered nearly a mile down the slope before stopping. The light was still quite ample to permit reading the maps, and it took only a few minutes to convince them both that this was indeed the tall, conical hill which Nick had reported. With this settled, however, neither could quite decide what to do about it. The natural urge was to return to the camp to report the phenomenon to Fagin; against this, however, lay the fact that they had another assignment to complete, which involved life and death.

"This can wait a day," John pointed out. "We can perfectly well camp right here, search our areas tomorrow, and then go back as was planned. We can't drop everything for one new discovery."

"I suppose not," agreed Nancy with some slight reluctance, "but we certainly can't camp here. There isn't enough fuel for a dozen hours on this black stone, to say nothing of the rest of the night; and the raindrops are starting to get clear."

"That I had noticed," replied John. "We'd better get going, then. Just a minute; there's enough here to make a torch. Let's get one started; we may be a little pressed for time later."

Nancy agreed with this observation, and ten minutes later they were on their way once more with John carrying a glowing torch and Nancy the material for two more, all that the vegetation within convenient reach afforded. They headed toward a region which their maps showed as having slightly higher hills than usual, so as to avoid finding themselves in a lake bed before morn-

ing. Both were becoming a trifle uneasy, in spite of Nick's earlier success at all-night travel; but they were distracted once more before getting really worried.

Again a light showed ahead of them. It was harder to perceive, since the brilliance from behind was still great, but there was no doubt that a fire of some sort was on one of the hilltops ahead of them.

"Are you going to sneak up on this one the way you did on the other?" queried John.

Nancy glanced at the now dangerously clear raindrops and did not condescend to answer. Her companion had expected none, and after a moment asked a more sensible question.

"What about this torch? If we can see that fire, anyone near it can see us. Do you want to put it out?"

Nancy glanced upward—or rather, shifted her attention in that direction by a subtle alteration in the positions of her visual spines, which acted rather like a radio interferometer system except that they were sensitive to much shorter wave lengths. "We'd better," she said. "There's plenty of light to dodge the drops." John shrugged mentally and tossed the glowing piece of wood under a settling raindrop. The two slipped up toward the distant light.

It was an ordinary fire this time, they could see as they approached. Unfortunately, there was no one visible near it, and the vegetation was not dense enough to hide anyone of ordinary size unless he was deliberately seeking to use it for the purpose. This suggested possible trouble, and the two explorers circled the hill on which the blaze stood with the most extreme caution, looking for traces of whoever had been there in the past few hours. Not having the tracking skill of the cave dwellers, they found no signs of people. After two full circuits and some low-voiced discussion, they were forced to conclude that either whoever made the fire was still on the hill but remarkably well hidden, or else the fire itself had been started by something a trifle unusual. The latter hypothesis would probably not have occurred to them had it not been for their recent experience with the volcano. There seemed no way, however, to decide between the possibilities by reason alone. Closer investigation was in order and, with a constant expectation of hearing the sharp voice of Swift echoing about them, they set to it. Very carefully, examining every bush, they went up the slope.

The climb bore some resemblance to a scientific experiment, in that its completion eliminated both of the hypotheses and left them completely without ideas for a moment. It was only for a moment however; as the two loomed up beside the small fire, which had quite obviously been laid by intelligent hands, a shout sounded from the next hilltop, three hundred yards away.

"John! Nancy! Where did you come from?" The startled investigators recognized simultaneously the

voice of Oliver and the fact that they had been a little hasty in eliminating possibilities; obviously they had missed a trail, since neither Oliver nor Dorothy could fly. Neither said anything about it aloud; each decided in private that the different vegetation of the area was responsible.

When Oliver and his companion came back to the fire from the separate hilltops to which they had taken on sighting John's torch, it quickly transpired that they, too, had seen the light of the volcano and come to investigate it. Their adventures had been very similar to those of John and Nancy, except that neither of them had tried hiding in raindrops. Oliver and Dorothy had been an hour or so ahead of the others, and had found a good supply of fuel, so they were well set for the night.

"I'll bet Jim and Jane will be with us before the night's over," remarked Nancy when both parties had completed their exchange of information. "Their search areas were even closer to this place than yours, Oliver, and unless they went 'way off course coming across country they must have seen the big light, too."

"Maybe they thought it was better to stick to their assigned job," remarked John.

"Isn't investigating bright lights part of the job?" retorted his partner. "Personally, if they're not here in an hour or two I'm going to start worrying about them. This fire-hill couldn't possibly be missed or ignored, and you know it."

No one had a suitable answer for this, but no one was really impressed by the reasoning, since they had all spent some time in discussion before coming to check the mountain. At any rate, the hours passed without the predicted appearance. If Nancy was worrying, she failed to show it; certainly none of the others were. It was a very quiet night, and there was nothing to worry about. The hours were passing, but that was normal; the light was getting brighter, but there was the peculiar hill to account for that; the rain was decreasing, but the hill might account for that, too. The fire was using up its fuel with unusual speed, but there was plenty of fuel. Doubtless the wind was responsible—none of them had ever experienced such a wind, and an air current one could actually *feel* would no doubt do many queer things. The four explorers stood by their fire and dozed, while the wind grew fiercer.

TO BE CONCLUDED

THE REFERENCE LIBRARY

BY P. SCHUYLER MILLER

REACH—

ONCE upon a time, Station WGY in Schenectady was the home of a very fine book-review program, called "Speaking of Books" after J. Donald Adams' column in the New York *Times*. Every week a panel of critics and experts badgered the author of a book currently in the news, with a lack of false restraint that occasionally brought the embattled writer to his or her feet screaming or slugging. The program had its ups and downs, moved to New York, changed its name, and I believe made a pass at TV before it died—not really, I hope, because a network VIP dreamed up the unhappy quip, "Books is for Schnooks," and liked it so well that he made it Policy.

The night that made the program, though, was the night Fanny Hurst got mad. The color and fury of the fireworks lasted a long time, but

what matters here is the trend of Miss Hurst's argument. Since none of her critics could write a book that would sell a minute fraction of the number of copies her disputed novel had already rolled up, she demanded, what #%&?!!! call had they to sneer at her skill as a writer?

It's a rather popular attitude, and is relevant here because one sector of fandom has been using it to attack James Blish's very critical reviews of past and current science fiction in *Science Fiction Times, Inside,* and elsewhere. Blish is second only to damon knight in his exacting standards for SF, and he calls his shots loud and clear. "Whyn't you shaddup?" the vigilantes scream. "Can you write as well?"

Well, sometimes he can and sometimes he can't, but the question is completely meaningless. You don't expect the referee of a prize fight to knock out the winner—or the loser, for that matter. Brooks Atkinson, the *Times* drama critic, isn't required to climb up on the stage and make like Big Daddy or Hamlet. Anybody, anytime, has every right to r'ar up and state his feelings about any writer of any story. And when Blish or knight or Sturgeon—or Atkinson, since I brought the matter up—does so, it's usually worth digging the plugs out of your ears and listening.

Let's sum it up with a nice literary quotation from the one-time Classics: namely, that Good Golden Poet of the Grand Old Days, Robert Browning:

"Ah, but a man's reach should exceed his grasp,
Or what's a Heaven for?"

The whole trouble with Blish—and knight, for that matter—is that he's a reacher.

Most of us, let's face it, are bone lazy. It may or may not surprise you to learn that this is a rather basic law of the universe: the Principle of Least Action. When we discover something that we can do very well, or pretty well, or well enough, our natural tendency is to go right on doing it as long as the pay or the applause or whatever we get out of it is reasonably steady and reasonably adequate.

Laziness has also been called the true mother of invention, but Man was very happy to go on using flint fist axes for a good many thousands of years, before he switched over to blade and flake tools and other unnecessary innovations that merely got him in trouble. Somewhere there's always a reacher . . .

Maybe Wug, who invented the bow and arrow, couldn't hit the side of a mastodon. Maybe Gloop, who baked the first clay pot, never learned to make the thing hold water. Maybe Imhotep, who designed the first pyramid, couldn't do hieroglyphic arithmetic. Maybe Homer couldn't hold a tune. Einstein certainly made his greatest contributions in front of a blackboard, and not in a laboratory. But they were all reachers.

James Blish demonstrated his

reaching ability very, very nicely in "The Frozen Year." He's demonstrating it again in an Avon paperback called "Year 2018!" (Avon No. T-193; 159 pp.; 35¢.)

This is a companion book to "Earthman, Come Home," the epic of the Okies and the flying cities, most of whose episodes were first published right here. It's an original, episodic novel that sets the stage and builds the world in which the Cities roved space. The English had sense enough to put it out in hard covers, over a year ago, as "They Shall Have Stars," but no American publisher has seen any reason for doing so. Consequently, the Avon edition is all there is.

"Year 2018" is the kind of book that may leave a first reader cold, or bring him up on his feet whooping. Blish is reaching like an acquisitive octopus. He is telling, not just one, but two suspenseful stories: one in which a probing spaceman tries to find out what is really happening behind the blank walls of a drug house, where newborn babies wail—the other in which psychologically drugged engineers build a meaningless bridge of incomprehensible materials, at the bottom of Jupiter's hellish atmosphere. He is setting the stage for the Okies and their spin-dizzy-driven cities of space—though nearly two thousand years elapse between the books. (He just might be making room for the planet-seeding of "The Seedling Stars" in the gap.)

But he is also saying something meaningful about the relentless responsibilities of complete power, as exemplified by Senator Bliss Wagoner of Alaska. He is showing us the open madness in the kind of dedication that Robert Helmuth and the other workers on the Jupiter Bridge must give to their senseless task. Being no man to throw away a plot, especially a good one inhabited by real people, he finally reveals the meaning of the meaningless.

And he is saying to me, not that means are justified by a necessary end, but that there can be justification for the most ruthless of means if the end is left open, so that Man finds a pathway to the stars through reaching that never ends.

Decide what you like about James Blish's grasping ability: he has one beautiful reach!

* * *

If you're curious about the appearance of SF writers, and can't get to SF conventions—even a regional one—look for the full-page advertisement that the Minneapolis *Star and Tribune* ran in various magazines and newspapers last fall, including the December 7th *Saturday Review*. Clifford D. Simak is making like a bookend—with some of his colleagues on the *Star*—for a shelf which includes his "Strangers in the Universe." Minneapolis recognizes good writers—all kinds of good writers.

* * *

I've just had word that the 9th Annual MidWestCon is scheduled

for the week end of June 28-29. As it has been for the last two years, since it outgrew Bellefontaine, Ohio, this "convention without a program" will take over the North Plaza Motel, 7911 Reading Road, Cincinnati 37, Ohio. You'll need the address, because you'll need a reservation—and don't lose any time making it.

This is a comfortable, modern motel on the outskirts of the city. There's a swimming pool on the lawn, a Howard Johnson's across the road, and other assorted restaurants nearby. This is the convention at which the fans are pros, and the pros are fans. Closest thing to a program will probably be some kind of windup dinner, with introductions, gags by Bloch, Tucker, Asimov, de Camp, Garrett, Silverberg. (I have to plug the pro contingent, because it's all the respect they'll get). You can haggle for books and magazines, collect autographs, play poker, juggle ice cubes, empty bottles, make friends, unmake them, or even sit in your room and wonder where everyone is, if you're that stupid.

Unfortunately, I can't pass on Lou Tabakow's recipe for getting free drinks from the committee. It would make a memorable convention if everyone followed through, but it would tax the resources of Cincinnati, just as Bellefontaine busted at the seams a few years ago.

THEY'D RATHER BE RIGHT, by Mark Clifton and Frank Riley. Gnome Press, New York. 1957. 189 pp. $3.00

Marty Greenberg goes right on getting more winners than any other specialty publisher. This, you'll recall, was Astounding's big serial of 1954-55, which won the '55 "Hugo" for best novel of the pre-convention year. I wasn't able to compare the book with the original magazine version, but it seems to me that it skips some riot scenes at the beginning and gets well into the story sooner.

If you've forgotten, or have discovered ASF since 1955, this is the story of "Bossy," a super-computer that has gone into hiding with its creators. I don't know whether there was a dianetic tinge to the original or not, but the machine, through psychotherapy, turns an old strumpet into a young, immortal, telepathic beauty—and the trouble starts.

Because there is a serious argument buried in the plot and action, just as there was in Jack Williamson's "Humanoids." Indeed, it is another facet of the same controversial question that was resolved so unsatisfactorily, for many readers, in the Williamson novel. Nobody can be made immortal who will not give up the collection of preconceptions, prejudices, and ingrained dogma by which he has lived. Those who would rather be right—and know they're right—must reconcile themselves to dying. But is it better for the race to be malleable and immortal, or steadfast in its convictions and vul-

nerable? Won't Bossy's beneficent ministry lead to the dead sterility that Williamson's too-helpful robots produced? Should the beat really inherit the Earth?

The most interesting character in the book isn't Joe Carter, the young telepath who masterminds the whole project in his search for another open mind, nor Mable, the made-over woman. It is Howard Kennedy, the industrial giant who maneuvers Bossy and her guards into his custody, then helps them find their place in society. I rather wish he had spoken his mind a bit more strongly, for I can't help but believe that the Kennedy's of this world will advance civilization farther than the infallible machines that direct our every step.

THOSE IDIOTS FROM EARTH, by Richard Wilson. Ballantine Books, New York. No. 237. 1957. 160 pp. 35¢

This is not a good title for the ten-story collection from a cross-section of magazines except this one. It seems to be an attempt to hook readers who went for the robust comedy of "The Girls From Planet 5," Wilson's previous book for Ballantine—but he quickly reveals himself as a better and more varied writer than that would imply.

In the rather confused title story, a monster computer manages to stave off an invasion by other robots, by presenting mankind as completely addled. "The Inhabited," next, is the one about an entity from elsewhere trying to find a home in human bodies; it starts nicely, then goes all solemn and rhetorical at the end. "The Hoaxers" is routine situation comedy: a couple of men rig up attacks by invisible creatures, to allay the boredom of their asteroid post, and then find themselves in the path of a real assault.

"Lonely Road" is very different: its hero finds himself seemingly alone on Earth—then back with everyone almost as he was before. "Love," as you might expect, is from *Fantasy & Science Fiction*: it's the beautifully done little story of a blind girl on Mars, in love with a Martian and disowned by her own kind for consorting with a "Spider." There isn't a false note in its simple sentiment—and then Wilson goes solid soap-opera for a sequel, "Honor," which F&SF did *not* print.

Now we're in the home stretch. "88 Beats 266"—a fact of Venusian life—is a ho-hum story about a possibly misunderstood wife of a Venusian colonist, saved by a heavy-handedly slugged gong. "Press Conference" is the slight and overly starry-eyed story of a United States President's visit from Mr. Kjal of Mars. And the book's one novelette, "It's Cold Outside," gives us one of those regimented societies in which a book publisher and his composer wife are gradually forced into open flight.

Nothing very distinguished, I

suppose, but "Love" may just get into the anthologies in time.

STAR GIRL, by Henry Winterfeld. Harcourt, Brace & Co., New York. 1957. 191 pp. $2.75

This is the book for younger children—eight to twelve, the publisher says—that I couldn't include in my recent roundup of juvenile SF. The cleaning woman had borrowed it, and she showed excellent taste.

The literary wing to the contrary, some of the best written books published today are for children. This author has done a juvenile detective story laid in ancient Rome, of which I've heard nothing but good—from kids as well as adults. Now he has turned the same skill to a delightful story about a little girl from the planet Asra, who falls out of a flying saucer into the middle of a German forest, is rescued by a completely believable assortment of children, and with their help manages to find her father again—in spite of the well-meaning efforts of a village full of block-headed adults who are sure little Mo is out of her head.

Nothing ambitious, and maybe the science won't all hold water—but if every SF book for youngsters were written with this skill, we'd find ourselves reading them instead of most of the current magazine offerings. Buy it for any eight-to-twelve you know, and see for yourself what good *really* juvenile SF is like.

TROUBLED STAR, by George O. Smith. Avalon Books, New York. 1957. 220 pp. $2.75

This is, I believe, a *Startling* "novel" of 1952 vintage. You should now know what to expect: pure entertainment, nicely served up by a man who knows how. Nothing at all like "Venus Equilateral."

It's a Danny Kaye situation: blundering extraterrestrials are about to convert our Sun into a flashing interstellar beacon when they discover that Earth is inhabited by people who will be unhappy if the project goes through. They have a solution: to pop the planet into a time-stasis, tow it away to another star, and wake everyone up again after a thousand-year nap. So they set out to find *the* Head Man of Earth, and get him to prepare his people for the move. Their mental compass directs them to Dusty Britton of the Space Patrol, ranking TV hero—and the fun has started.

Dusty, incidentally, adds up to a surprisingly solid and believable guy. *Why* won't the movies give us simple things like this, played straight, instead of those weary old monsters?

GREAT WORLD MYSTERIES, by Eric Frank Russell. Roy Publishers, New York. 1957. 191 pp. $3.75

I've had the English edition of this book, and am assuming the American is the same. Eric Frank

Russell needs no introduction to readers of Astounding, but this approach is not the one we know best. Sometimes it's tongue-in-cheek; sometimes the tongue seems to be hanging out in amazement. I think you'll find most of the mysteries familiar from many and many an *American Weekly* feature, or its counterpart; their common feature is that they are insoluble for lack of appraisable evidence.

Opening with the classic "Mary Celeste" case—the ship whose crew vanished into thin air, back in 1872—Russell comes up with a novel and fairly plausible hypothesis: that there was ergot in the ship's flour, or part of it, and that this treacherous fungus, when it got into their day's bread, drove everybody into an insane frenzy in which they went overboard.

Then there are the strange "Devil's" footprints that are supposed to have tracked through the snow across a hundred miles or so of England, back in 1855. Several equally mysterious parallels are cited, but I can't quite go "Russell's snow-runner." I suspect he can't either.

Easter Island . . . Kaspar Hauser, the boy out of nowhere . . . the British courier who stepped around the horses and vanished . . . wandering coffins in Barbados and elsewhere . . . Eusapia Palladino and her "demonstrations" of levitation . . . death by "spontaneous combustion" . . . various sea serpents . . . assorted flying saucers: these complete the book. The treatment is a sort of light Charles Fort—entertaining, but I'd rather read his fiction.

SARGASSO OF SPACE, by Andrew North.

THE COSMIC PUPPETS, by Philip K. Dick. Ace Books, New York. 1957. No. D-249. 192+127 pp. 35¢

I'm giving the reprint of Andre Norton's good adventure yarn top billing in this Ace Double, because it's science fiction, and of the best kind, whereas Philip K. Dick's story has gone all the way over into fantasy this time—even if it did appear in *Satellite* in 1956.

The "North" (Norton) book follows Dale Thorson and the crew of the space-trader *Solar Queen* as they explore—and promptly get in trouble on—the strange world, Limbo, in the far reaches of the galaxy. Here's a master hand at "sense of wonder" writing.

Dick follows his hero, Ted Barton, into the little Virginia hill-town of Millgate, where he was born and brought up. But Millgate has completely changed. Landmarks are gone—people are different—the town's history, as revealed in the files of the local paper, is unlike the events he remembers. Ghostly figures walk in and out of the walls and furniture, and there are two exceedingly peculiar children who are carrying on a nasty war of their own which somehow stands for a more important conflict behind the scenes.

Ted finds he can't get out again—he is shown two god-things looming over the valley and manipulating its people—and he begins to spy traces of *his* Millgate hidden in and under the mirage. "Eye in the Sky" I'd let in as SF; this I won't.

WATER UNLIMITED, by Kenneth Roberts. Doubleday & Co., Garden City, N. Y. 1957. 285 pp. $3.95

This third book in the saga of Henry Gross, dowser, is no more satisfactory than the first two as evidence of what happens when a gifted individual finds water, or of what his ability can contribute to our geological knowledge.

Dowsing, it seems clear, is one of the more important psi abilities, akin to clairvoyance and telepathy. Henry Gross, whose wand "told" him where water would be found in localities he knew only from rough sketch maps, is apparently a very gifted dowser. Unfortunately Kenneth Roberts, who elected himself Henry's mentor and manager, was a man of strong opinions and emotions, who got mad at people who failed to see things his way, and assumed that they were impugning his own reputation as a journalist and historical researcher. The books that might have contributed as much to our knowledge of dowsing as Mr. Roberts' novels have to our understanding of American history, instead degenerated into a running chronicle of incessant skirmishes between the Ungodly and the Saved. This time, Leonardo da Vinci is dragged in as a "scientific" authority for Henry's ideas about "domes" and "veins" of water in the ground. Kenneth Roberts would never have accepted this kind of evidence when he was working on one of his historical novels.

Let me say that the attacks on the Roberts-Gross books, by orthodox geologists—at least, those that I have seen—have been just as unreasoning and unreasonable as Kenneth Roberts' chip-on-the-shoulder defense. Their general tone has been that "there's ground water everywhere, so anyone can find it." Thousands of dry wells attest that this just is not so. They ridicule the concept of "veins" of water in the ground—yet a ride through the country will show innumerable springs and seep-spots at *isolated* places (even in the middle of an asphalt highway) on the face of a rock or earth cut. Cut a vein and it bleeds, doesn't it?

What's more, what I take to be geological gospel now holds that the Earth's present surface waters were once dissolved in the rocks of the interior, and have welled up to the surface through the millennia, by way of fault lines, cracks, crevices, and what have you. Last fall, in the Adirondacks, I found a full-flowing brook in a notch between two small mountains, at a time when streams that drained much larger watersheds were dry or nearly dry. This could *not* have been surface water—it was coming up through the much-faulted rock. (There's a spring within a

few feet of the summit of Mount Marcy, highest peak in New York State, and another on Whiteface: what price surface drainage there?) But if water does well up out of the Earth's crust, can't it be called a "dome"?

I wish someone with Kenneth Roberts' tremendous vitality and drive, but without his bullheadedness and intolerance of nincompoops, had teamed up with Henry Gross. We might have learned a lot about where to find water.

THE PLANET VENUS, by Patrick Moore. Macmillan Co., New York. 1957. 132 pp. $3.00

I think science-fiction readers will find this statement of the state of the art of interpreting Venus a bit disappointing, and writers less useful than they might have imagined. The fault is not wholly the author's: we just don't know enough about Venus to give any very positive answers about what it's like there. And Mr. Moore is an astronomer of rather conservative character, who is not one to dignify unworthy notions with space in his books. (He has been downright vitriolic, elsewhere, about the nonsensical meteoric theory of the lunar craters and refuses to discuss it.)

We don't even know—and not for want of trying to find out—the length of the "Cytherean" day, or the location of the planet's poles. The author is so incautious at one point as to call certain markings he has seen, "polar caps," but he does it in quotes and without prejudice to his impartiality. I suspect he now tends toward the Zollner-Pickering-Whipple-Menzel theory of an all-sea Venus, as opposed to all dust, or a world with formaldehyde clouds, but he's no violent partisan of anything but the non-visibility of surface markings.

Incidentally, what price some pioneer work in terraforming by dropping assorted bacterial, algal, and other cultures into the Cytherean clouds? Maybe the process that converted Earth's carbon dioxide atmosphere into an oxygen one can be seeded, so that our sister planet will be ready when we need it.

REPRINTS IN PAPER—

ROGUE IN SPACE, by Fredric Brown. Bantam Books, No. A-1701. 163 pp. 35¢

Pretty good going until a sentient asteroid brings a no-good "hero" to life. Brown's worst or second-worst SF novel, depending on how you feel about "Martians Go Home."

THE CITY AND THE STARS, by Arthur C. Clarke. Signet Books, No. S-1464. 191 pp. 35¢

The expanded novel based on "Against the Fall of Night." Clarke at his most poetic—and he has few rivals nowadays.

5 TALES FROM TOMORROW, edited by T. E. Dikty. Crest Books, No. S-197. 176 pp. 35¢

From Dikty's annual anthology, "The Best S-F . . . 1955." "The Cold Equations" is here, with others by Simak, Abernathy, Friborg, and Everett B. Cole's "Exile," also first published here. They date from 1953 and '54, in spite of the original title.

THE CREATION OF THE UNIVERSE, by George Gamow. Mentor Books, MD-214. 144 pp. 50¢

A great popularizer of "conventional" astronomy; the book is one of a trilogy with "Birth and Death of the Sun" and "Biography of the Earth" (Mentor MD-120 and MD-138). Gamow holds that all the atoms now in the universe were made in less than an hour—three billion years ago. His book doesn't seem to have been revised since the original edition appeared in 1952.

THE PLANET EXPLORER, by Murray Leinster. Avon Books, No. T-202. 171 pp. 35¢

Gnome published this earlier in the year (1957) as "Colonial Survey," and all the stories appeared first here in ASF. It's Leinster at his highly professional best, building suspenseful stories around scientific gimmicks without ever being dull.

FRANKENSTEIN, by Mary Shelley. Pyramid Books, No. R-290. 192 pp. 35¢

They've put Boris Karloff's classic monster on the cover, but after all, it *was* written in 1816. The Monster talks and talks and talks . . .

THE TIME MACHINE, by H. G. Wells. Berkeley Books, No. 380. 96 pp. 25¢

Another "first of its kind" that wears better than "Frankenstein." Wells' imagination never quite caught another vision like that of the dying Earth.

THE END

BRASS TACKS

Dear Mr. Campbell:

Having the utmost respect for that wizened and rather energetic sage, Finagle, I would like to add to the list being compiled:

1. Those factors which *cannot* go wrong, will probably go wrong anyway.
2. No matter what goes wrong, it will probably look right.
3. When an error has been detected and corrected, it will be found to have been correct in the first place.

Corollary I.

After the correction has been found in error, it will be impossible to fit the original quantity back into the equation.

I have found that "Finagle's Variable Factor" is known in aviation circles as Murphy's Law.

Well, that's all this unworthy knows. The final list should be extremely enlightening. — Frank H. Scott, 1390 N. Hague Avenue, Columbus, Ohio.

Not really enlightening—it's more a Copendium of Bafflement!

Dear Mr. Campbell:

I was most surprised that Katherine MacLean allowed her collaborator to write the following in "Second Game," the story which appeared in the March, 1958, issue of your fine magazine: "Because the acquiring of weight was the corollary with the

Veldian women becoming sexually attractive, their men had an almost universal preference for fleshy women. As a result many of our (human) women who would have had difficulty securing human husbands found themselves much in demand as mates of the Veldians." As I said, I was surprised because, as a woman, Miss MacLean should be acquainted with one of the Male-Versus-Female Laws generally accredited to *Mrs.* Finagle which states:

> The fleshier the woman, the greater her chances of securing one or more husbands. (Mrs. Finagle herself weighed two hundred fifty pounds and buried three husbands.)

"Second Game" was, as a consequence, unrealistic. Rather than losing most of their fleshy women to the Veldians, human males would have risked having their Ten Thousand Worlds reduced to rather large cinders, assuming, of course, that their reaction to human women was the same as it is today. Do *you* know any fleshy women who have not managed to marry despite the slim sack-look in clothing, the wails of heart specialists, and the before-and-after-dieting pictures contained in every issue of women's magazines?

For the edification of those readers who have not had the pleasure of reading her most comprehensive book entitled "Canning Made Easy With Klein Bottles," Mrs. Finagle was the wife of the eminent scientist who has been accredited with the production of the First Law of Scientific Research:

> In a laboratory experiment, if anything can go wrong—it will.

Mrs. Finagle chose to stay out of the laboratory, but she collaborated with her husband in compiling the Male-Versus-Female Laws over the breakfast table and at night after the good professor had trudged home wearily from a hard day of battling Bunsen Burners. In some of the Laws, Professor Finagle's influence is definitely felt:

> For every man who leaves the cap off the toothpaste, there is a woman who drapes soaking wet stockings over the shower fixtures.

However, in others, Mrs. Finagle's thoughts must be given credit:

> The depreciating cries of human males increase in direct proportion to the changes in styles of feminine clothing, no matter what those changes may be.
>
> The more efficiently human females perform mechanical tasks, the more human males will insist that they can perform the same tasks as easily and as well (hence, the jeering term, "woman driver.")
>
> The wariness of the human male decreases in direct proportion to the number of artifices the human female employs to trap him.

In attempting to collect these Male-Versus-Female Laws, I have

found that none can be given preference over others since "female" is a variable constant, and "male" is an inconstant variable.

Mrs. Finagle's contribution to scientific method should be as widely recognized as that of her husband. The Male-Versus-Female Laws are as immutable as the Battle of the Sexes; I trust you will agree "Vive la Guerre!" goes without saying.—(Miss) Irene Baron, (112 pounds and still single), 475 Oxford Street, Rochester 7, New York.

Was it Mrs. Finnagle who pointed out that every one of Mankind's great heroes was a man who expressed his high regard for the opinions of a woman—and every great villain of Mankind was a man who repeatedly expressed his complete contempt for the opinions of women? But I think it was Dr. Finnagle who sadly remarked "He travels fastest who travels alone . . . but he hasn't anything to do when he gets there."

Dear Sir:

I protest the letter sent by Baron Hans von Eisenbeiss in your February issue. It is a low-down letter typical of one of his breed. I do not dispute his thesis, nor that of Mr. Eric Frank Russell. All the literature would seem to indicate that the cats will be the first to seek the stars. They have been members of crews of Earth-bound ships, and it's a rare dog that is.

We do not stoop to lick the boots of our persons. They know what we consider important, because we are never servile. They value our opinion and we are necessary for exploration. It is said the Earth shall be inherited by the meek, which is a subtle reference to its going to the dogs eventually. We'll go to the stars.—Peop Ho Songcat, Royal Siamese (as dictated to her person,) Barbara Bower, 1411 N. Commerce Street, Stockton 3, California.

Sorry, but the dogs have already led the way to the stars. One of the major differences between the dog and the cat is that dogs have repeatedly shown their willingness to give their lives to save that of their human symbiote. It is now a forever-unalterable fact that the first of Earth's species to go into outer space was canine, not either human or feline.

Dear John Campbell:

It is with great interest that I read of Mr. Hoadley's resumé of the various constants which he calls Finagle's, Bugger's, and Diddle's, respectively. He points out that the discoverer of the last named was Roland Featherstonebaugh Diddle. (It might be of interest to know that recent research on his family tree shows him to be a direct descendant of the Eleventh Century Norman knight, Sir Roland de Delle of the suzerainity of William the Conqueror's father.)

However, fascinating though this may be, it appears to me that you engineers are way behind us chemists in the all-important generalization of foul-up factors. In our analytical lab we have uncovered a whole infinite series of these factors, applicable—as every analytical chemist knows—to any chemical analysis whatever. The general Snafoo equation reads as follows:

$$x' = K_F + K_B x + K_D x^2 + K_3 x^3 + K_4 x^4 + K_5 x^5 + K_6 x^6 + (\text{et cetera})$$

where x represents *your* results and x′ is the results you *should* have obtained, but didn't.

The first three K's have been named after their respective discoverers; the remainder of the infinite array are still lacking in proper honor. In case more people come along who need to have a coefficient named after them in recognition of meritorious fouling-up, we chemists offer all of our unnamed factors freely.

And if you feel that perhaps the terms belonging to x's of higher degree may have magnitudes too small to lend proper dignity to any proposed honoree, let me be quick to point out that unlike an ordinary Maclaurin Series, the Snafoo series does NOT converge. You have as much chance of finding a big coefficient at $K_{10} x^{10}$ as at $K_B x$. We made another important discovery: The coefficients are free functions of time and space. All you have to do to prove this is to move your equipment down the hall while they are cleaning up and repainting your own lab, and you'll see. You cannot duplicate last week's data, and moving back doesn't help either. The most shortsighted lab chief is the one who blandly says: "Let's run it just *once* more to be absolutely sure." Who was it who said that if you wish to keep your faith in Science you should never make an experiment?

We also have a word for the excellent observations of H. B. Fyfe. He has set forth Finagle's (or, more correctly, as you point out, Von Nagle) Laws with their corollaries along with examples for each. There is a Fourth Law of Revision, usually encountered only by chemists who, after painstaking and time-consuming analysis of a sample are suddenly told that it is the wrong one and doesn't apply to the problem. This is generally solved by use of the next unused coefficient in the Snafoo Series, called the Tohellwithit Factor. —John P. Fairfax, 1620 Howard Avenue, Burlingame, California.

Apparently neither Von Nagel, Bougerre, nor Diddle attacked the problems associated with the Relevance Correlation, since Relevance is a factor of Analogic, and is not subject to logical or mathematical analysis. It would be very appropriate if John Fairfax would work it out properly; it would probably wind up with something on the order of "Any facts which,

when included in the argument, give the desired result, are fair facts for the argument." This, obviously, would be known appropriately as the Fairfax Law. It would, in effect, be the expression of the general Class, of which the Von Nagel, et cetera, laws are sub-sets.

Dear Mr. Campbell:

Several months ago, as a service to the industry, we formed the International Society of Philosophical Engineers at the suggestion of several new M. I. T. graduates who missed this important phase of their education while at school. We understood at the time that the original idea of such a society was the outgrowth of a meeting of several disgruntled freshmen who had flunked Philosophy I. We ran off several hundred membership cards which were distributed nationally to deserving engineers. A Recommended Practices Committee was formed with the duty, among others, to compile a representative selection of Finagle's Laws.

Your worthwhile endeavors along this line have been brought to our attention. Since our esteemed President, Dr. Bougar T. Factor, has been nearly suffocated in society red tape and analogous paper work, he has happily consented to step down as Chairman of the Recommended Practices Committee in your favor, and the Board of Trustees voted a unanimous confirmation. Your membership card, and the work of the committee thus far is enclosed.

We are at present subsidizing research to check further into the spelling of Finagle. Some of our Irish members, including our printer, insist that two "n"s are correct. Dr. Factor has done some intensive prying into Finagle's early life, and bears out the fact that Finagle was not an educated man, but an itinerant Irish hod-carrier who made a hobby of sticking pins in pompous engineers and architects at the turn of the century. Dr. Factor further points out that the term, "Finagle Factor" is an anachronistic error of association. This association dates from the atavistic urge of several Irish students at Cornell to attribute this important work to their ancestral species.

Since Dr. Factor is a direct descendant of the French mathematician, Bougierre de Facte, he naturally resents any attempt to take credit from this famous man. As you will recall, Bougierre supplied Dr. Guillotin with the calculation for the correct amount of weight to attach to the guillotine blade in order to neatly shear the area of the second and third cervical vertabrae without undue penetration and damage to the bottom blade-stop.

We greatly appreciate your work in this field, and will look forward to the complete compilation of Finagle's Axioms which you intend to utilize for the benefit of the engineering fraternity.—Hugh C. Dorworth, Jr., Chairman, Western Pennsylvania Section, ISOPE, Oil City, Pennsylvania.

THE RECOMMENDED
PRACTICES COMMITTEE
of the
INTERNATIONAL SOCIETY OF
PHILOSOPHICAL ENGINEERS
presents
A Compilation of Finagle's Universal Laws for Naive Engineers

Axiom #1 In any calculation, any error which can creep in will do so.

Axiom #2 Any error in any calculation will be in the direction of most harm.

Axiom #3 In any formula, constants (especially those obtained from engineering hand-books) are to be treated as variables.

Axiom #4 The best approximation of service conditions in the laboratory will not begin to meet those conditions encountered in actual service.

Axiom #5 The most vital dimension on any plan or drawing stands the greatest chance of being omitted.

Axiom #6 If only one bid can be secured on any project, the price will be unreasonable.

Axiom #7 If a test installation functions perfectly, all subsequent production units will malfunction.

Axiom #8 All delivery promises must be multiplied by a factor of 2.0.

Axiom #9 Major changes in construction will always be requested after fabrication is nearly completed.

Axiom #10 Parts that positively cannot be assembled in improper order will be.

Axiom #11 Interchangeable parts won't.

Axiom #12 Manufacturer's specifications of performance should be multiplied by a factor of 0.5.

Axiom #13 Salesmen's claims for performance should be multiplied by a factor of 0.25.

Axiom #14 Installation and Operating Instructions shipped with any device will be promptly discarded by the Receiving Department.

Axiom #15 Any device requiring service or adjustment will be least accessible.

Axiom #16 Service Conditions as given on specifications will be exceeded.

Axiom #17 If more than one person is responsible for a miscalculation, no one will be at fault.

Axiom #18 Identical units which test in an identical fashion will not behave in an identical fashion in the field.

Axiom #19 If, in engineering practice, a safety factor is set through service experience at an ultimate value, an ingenious idiot will promptly calculate a method to exceed said safety factor.

Axiom #20 Warranty and guarantee clauses are voided by payment of the invoice.

NOTE: While the accuracy of the above Axioms is vouched for, the Committee does not feel that this compilation is by any means complete. The Committee will welcome any additions conforming to good philosophical engineering practice to the list.

Bougar T. Factor, Chairman

Axioms 2 and 5 stem from Finnagle's more fundamental observation that "The most important leg of any three-legged stool is the one that's missing."

Dear Mr. Campbell:

In re: "Demonstration, Part 3"—I assume that the "mixture of sand, gravel, and asphalt" you use as an example would constitute macadam paving. Let us suppose that for some reason the asphalt did *not* harden—then there would be no road, no "hard, stable, and strong" surface to walk, drive, or park cars on. Likewise, if we human beings did *not* tend to cling tenaciously to a body

of culturally, experientially, and authoritatively acceptable ideas there could be no civilization as we know it. Parents would not know what to teach their children; and without a store of tested and accepted information passed on from generation to generation the development of a culture or civilization is impossible. So if our primitive ancestors had kept their minds truly open to new ideas our culture and way of life would simply not exist—we would be as primitive today as those early ancestors were.

On the other hand, though, you have an excellent point regarding Semmelweiss, Pasteur, et cetera. It is highly regrettable that men with revolutionary new ideas about the facts of the universe we live in have so much difficulty getting a fair hearing and trial for their ideas. Still, as pointed out above, skepticism toward radical ideas is one of the necessary bases of societal, scientific, and personal integration.

Such is the dilemma. Perhaps it might be eliminated—or at least minimized—by the creation of an Institute for the Investigation of New Ideas. This institute would be composed of young, well-trained men—in all occupational fields—having more than the usual capacity to entertain seriously the possibility of radical innovations in currently accepted postulates. They would be replaced every five years by a new group of young men. These qualified men would work with the innovator in testing the new theory. If they

found it valid, they would so certify to all concerned. Thus, scientists, technicians, and the public would be presented with any valid radically new idea already tested and approved by an established authority—the institute. And, on the other hand, they would be protected from those which proved invalid. (Incidentally, it occurs to me that the successful functioning of such an institute could be the basis of a very interesting science-fiction story.)

As for a definition of the meaning of "to demonstrate," I offer the third definition from *Webster's New Collegiate Dictionary* (copyright 1951): "To explain or illustrate, as in teaching, by use of examples, et cetera." This definition will hold up regardless of the degree of acceptance and/or understanding of the audience.

One small part of your editorial I would like to take issue with. That is your suggestion that the hospital obstetrician—if he could properly be called that—of Semmelweiss' day was "sorrowing at each young mother's death." I suspect, with the mortality rates they had to face, the more idealistic and sensitive ones soon weeded themselves out—leaving a group of doctors who accepted the then current mortality rate from childbed fever as inevitable. More probably, the reason for their resentment of Semmelweiss is that they felt their professional competence was being challenged. In other words, their self-respect and self-esteem were being threatened—naturally, they would react violently.

The main argument of "Demontration, Part 3" can be restated simply as the fact that each person is "ego-involved" with those ideas which he firmly believes to be unshakably true. If any of them is seriously challenged, the individual will be disturbed, made to feel insecure; and he will react accordingly *—regardless of whether or not his belief is the "truth" he takes it to be.*
—Ellen Kahn Crouch, "Casablanca," Sterling, Virginia.

Information theory shows that the only thing you cannot learn is something you already know.

Psychology can probably show that anything you believe you know prohibits learning what you need to know.

Dear Mr. Campbell:

As students at the Missouri School of Mines we have noticed several omissions in the works of the great Dr. Sean A. Finagael. We hasten to forward these items so that they may be brought to the attention of all.

1. Finagael undoubtedly invented the frictionless pulley, inertialess mass, and Ideal Gas.

2. He assisted in popularizing the following units:

a—Furlongs per (Fortnight)^2 —measure of acceleration

b—Jiffy—the time it takes light to go one cm. in a vacuum.

3. It is probable he assisted in the formulation of the English system of measurements.

4. The specific heat of an argument is equal to the fourth power of the stupidity and the thirty-seventh power of the ignorance of the arguers.

5. The Prime Theorem states that certain random variations—the famous factor — in the values of Planck's constant magnify the effect of the Heisenberg principle of indeterminancy. All other of his laws may be derived from this assumption.

6. Hell hath no fury like an unjustified assumption.

7. If enough data is collected anything may be proven by statistical methods.

The man who graduates from college and has never applied Finagael's Laws probably majored in basket-weaving. — Paul L. Williams (EE), Theodore W. Holland (Geologist), c/o Tate, Highway 66 and Pine Street, Rolla, Missouri.

Perhaps also the units "stones per acre" as a unit of pressure, derived from experience with the fields of Connemara and Galway. Also the measure of resistance to traffic flow on a highway—the "frustrum per mile," proportional to the summation of the fourth powers of all accelerations experienced by a driver seeking to maintain the legal speed maximum on the highway under study.

THE END

(*Continued from page 7*)

I'm not suggesting that noncommunication is desirable—but that it be observed as a simple fact that noncommunication somehow does have a stimulant effect!

May it be because, when barriers are erected between groups of scientists, they tend to drift apart from each other . . . and immediately start getting a cross-checking viewpoint from a somewhat differently oriented group? Because the security barriers are usually erected in wartime, and while one group of scientists is not communicating ideas to the other . . . the results are very definitely, and usually painfully, communicated.

Our scientists had it all worked out that only tritium could be triggered into thermonuclear reaction. The Russians had a different viewpoint; it was a highly painful shock when the Russians communicated their results by triggering a lithium hydride bomb. Dr. Teller was the man who cracked the "impossible" problem of figuring out how that could be done.

One of the inherent liabilities of a world-wide communication of scientific ideas is that then *all* scientists would be dragged into thinking about problems in the same way. If our AEC had freely and widely communicated their work on the thermonuclear bomb, had freely published their data showing that only tritium could be triggered . . . it might well have been that the Russians wouldn't have figured out the lithium hydride trick. They would have followed loyally behind the sound and solid logic our scientists developed.

One of the most magnificent pieces of intellectual sabotage on record is a perfect example of that mechanism —this instance being a conscious, intelligently planned effort to sabotage an enemy.

When the Nazis invaded Holland, they captured, among others, a Dutch mathematical physicist, renowned for his analytical work on electronic-physics problems. They asked the Herr Doktor to make an analysis of the possibilities of microwave radio in radar. (At that time, frequencies around five hundred megacycles were the highest used for radar.) The Herr Doktor went to work diligently, and in about six months produced a two-inch thick tome, comprising an acutely reasoned, mathematical demonstration that microwave radar was futile. Absorption in the atmosphere, high noise level, serious disturbance due to refraction by atmospheric irregularities . . . it all added up to a useless proposition.

The Nazi scientists went over the renowned scientist's work; it was beautifully, and tightly reasoned. It was an excellent analysis. The Nazis officially banned waste of manpower and material on microwave research, since it had been proven futile.

When Allied microwave radar was locating and sinking their subs, they sent out several specially equipped expeditions trying to find what the secret was. It didn't work well, because all of their expeditions were sunk, after being located by micro-

wave radar . . . which they couldn't detect, since microwaves were known to be useless. The Nazis were studying infrared detection systems.

Meanwhile, the Dutch mathematician succeeded in escaping to England . . . complete with his private, secret report on microwave possibilities. He hastened to the British government, to show them that microwaves were The Answer. The British, of course, complimented him on his analysis, and said, in effect, "Yes . . . we know. We're using it." And, of course, most heartily and warmly thanked him for the magnificent piece of intellectual sabotage he had pulled on the enemy.

What the intellectual saboteur had done was to present, in his report to the Nazis, a mathematically impeccable argument . . . in which every uncertain factor had been weighted on the unfriendly side. Each value that might lie between a value x and another x' had been given the least favorable aspect. The final result contained not one point that wasn't fully and reasonably defensible . . . but the accumulation of prejudiced judgments, nowhere individually noticeable, damned the entire microwave concept.

Every Nazi scientist who went over his report followed his argument, reasonable at every step of the way . . . and wound up sabotaged for the duration of the critical period. Not until a functioning microwave radar unit fell into their hands was the effect of the sabotage broken.

It is because of precisely such phenomena that science does, indeed, need fans—amateurs who can't follow the brilliant argument of the saboteur, but get a general impression that something seems funny.

The saboteur doesn't have to be conscious, of course; if a man misleads himself, he can very effectively mislead others. The case of the Dutch mathematician is unusual in that he did *not* mislead himself, and did knowingly mislead others.

Human beings have learned, over a long time, and by the long, hard way of getting it drubbed into their hides, that a government works best when there is His Majesty's Loyal Opposition, or its equivalent. When

there are Republicans and Democrats. When no one group, however honest, sincere, ethical, wise, and careful it may be, is able to act on its own, un-cross-checked thinking.

Science does, indeed, need fans—fans who can bring up unorthodox ideas, and have some consideration and respect from the scientists, no matter how unpleasant the proposed change in the Rules of the Game may sound.

The trouble now is that professional scientists can't get their necessary science done, and take time off to listen attentively to all the amateurs with original ideas. You can bet that something like 99.99% or better of all proposed original ideas are not only original, but unique—they exist nowhere in the Universe save in the originator's noggin. Since the amateurs outnumber the professionals by several hundred to one . . . the professionals can't do their work, and screen the amateurs, too.

What seems to be needed is an organization of amateurs who will screen the amateurs with ideas. The amateurs do not outnumber the amateurs, obviously! But this will be of no value *unless the organization of amateurs is respected by Science.* Unless Science will acknowledge that an individual who has no professional training in the field, has not performed any new experiments, has no access to new data, but only old, well-known data, can make an important and original contribution.

Be it noted: Newton had no access to new data. He used Kepler's data in working out the Law of Gravity. He performed no new experiments. (Other people had apples drop on them, too.) He found a new meaning in old data.

Recently, we published an article on "Correlation of the Martian Canal Network," by Wells Alan Webb. The author is not an astronomer, and had no new data; he used old maps of Mars, plus simple observation of crackle-ware glass, crazed glazes, mudcracks, and cracked lava flows. But the contribution he made was original, and valuable; the article has been published in the *Journal of the Astronomical Society of the Pacific,* and elsewhere.

Until Science can be made to accept the reality of its own beginnings —with Gentleman Amateurs—and that the beginning is a good, and worthy beginning, and that there is new science to be found in those same places today . . . there can be no science fans.

Until an organization of amateurs that Science respects *as an organization* exists, the one immensely valuable amateur idea in ten thousand will be lost because of the inability of scientists to take the time to review such ideas adequately, or open-mindedly.

And I say "inability to . . . review . . . such ideas . . . open-mindedly" in very specific terms; please note the terms carefully. *Pressure of time can close a mind as tightly as fanatical prejudice.* The *effect* is a closed mind . . . whether the mind is closed by bigotry or sheer pressure of time

has no bearing on the fact that no idea can be communicated. The old "Do Not Speak to the Motorman" is simply an injunction "Do not even try to induce the motorman to react in an open-minded manner."

Science does indeed need fans. Baseball fans tip off the Major League scouts to young, new talent rising in the backwoods leagues. Only the fans are numerous enough, and widespread enough to see all, know all, and report all. After all, it was a Mexican peasant farmer who first observed Paracutin coming into existence—not a volcanologist. The volcano appeared on his land; the amateur was there on the spot.

It has been the Gentleman Amateur, down through the centuries, who has built science, not merely professionals, formally trained. Priestly, discoverer of oxygen, was a Unitarian minister, who became interested in "Natural Philosophy" from discussions with that publisher, philosopher, writer and politician Benjámin Franklin. Gilbert, who founded the science of magnetics, was a physician, with a Gentleman Amateur interest in his hobby.

The fabulous Royal Society of London was not an organization of professional scientists—but of Gentleman Amateurs. It was that organization, though, that *found* the great scientists England produced over three centuries.

In summary: Science does need fans—but if it is to have their help and support, Science must accept them, and their comments with respect, even when their comments are painfully emphatic, and impose major reorientations on Science.

Science needs them, because any group, just as any individual, needs cross-checking by a nonidentical group with somewhat different basic orientations and beliefs.

Also, Science needs an amateur organization to screen the thousands of amateur ideas that arise constantly. At present, Science can't listen open-mindedly, because of the sheer pressure of time, and quantity of ideas. In order to shut out the furious babbling of ten thousand would-be innovators, Science has in effect shut out *all* communication from outside.

An organization of amateurs that Science would respect could relieve that problem. But . . . it will do no good whatever unless Science respects that organization, acknowledges its respect publicly, loudly, and often, and proves that it means what it says by genuinely paying attention. Reason: the would-be innovator is not going to be satisfied by telling his tale to an organization that wouldn't be able to do anything about it even if it did find merit in his proposal. He'll simply ignore the organization to exactly the degree that the professional scientist does.

Third, the Gentleman Amateurs have, in the past, made many of the greatest contributions to Science. They still can; it doesn't always take new data—simply a new understanding of the old. Einstein never performed any experiments; he sim-

ply thought about the data other men had worked out. And he, after all, was a Gentleman Amateur—a patent office clerk.

Finally, most observations of rare phenomena will be made by amateurs, not by professionals, Reason: there's a ratio of about one million to one. Sheer probability gives the amateur a greater chance of seeing a rare, critical phenomenon first.

Ball-lightning was seen, and reported by amateurs for years. Physicists consistently denied its reality. "No competent observer," they said, "has ever reported such phenomena. We know it is impossible; no structure of electrostatic forces could remain stable." If physicists had respected the amateur observers, they'd have been directed to the study of plasmoids forty years ago. Had they done so—and all necessary mechanisms for the general understanding of plasmoids existed then—studies of thermonuclear fusion reactions would have started *before* fission was discovered. We might, then, have had fusion power before 1945.

The "pinch effect" on which the "magnetic bottle" involved in plasmoids is based was known in 1910 to those in the electric-furnace business.

The professional scientists had all the knowledge necessary to explain ball-lightning in 1920. If they had respected amateur observations adequately, and accepted the stimulus of the demand to explain an observed natural phenomenon . . . they could have. They couldn't have duplicated it, of course; lightning involves currents of up to 50,000,000 amperes. In 1920 they could approximate lightning voltages—but to make plasmoids in the atmosphere takes not only the megavoltage, but the megamperage.

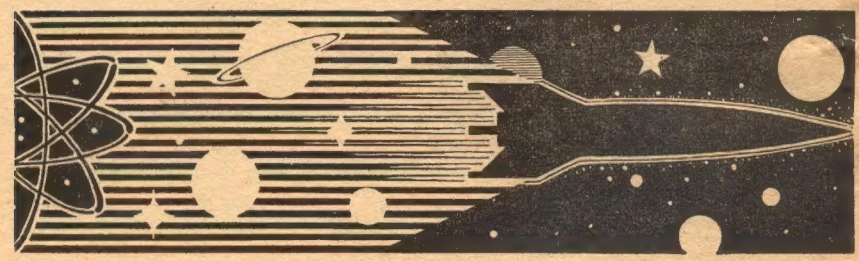
The amateur, by his sheer numbers, can observe the rare natural phenomenon that could, if accepted, give Science invaluable clues.

A respected organization of Gentleman Amateurs of Science is definitely needed. Dr. Teller is right . . . even if he doesn't quite like the results of such an organization!

Science fiction seems to be the nearest approach to such an organization now extant. Maybe we can do something about it, huh?

THE EDITOR.

THE END



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